Self harm is an independent predictor of mortality in trauma and burns patients admitted to ICU
g
James Varley a,*, David Pilcher b, Warwick Butt b, Peter Cameron b

aAddenbrookes Hospital, Cambridge, UK
bThe Alfred Hospital, Monash University, Melbourne, Australia

Article history:
Accepted 3 June 2011

Keywords:
Trauma
Burns
Suicide
Intensive care

ABSTRACT

Background: Patients with mental illness or depression may sustain self-inflicted injuries that require admission to an Intensive Care Unit (ICU). It is unknown whether the intent of injury leads to a greater likelihood of dying over and above the severity of the initial injury.

Given the economic and societal burden of injury of self-harm, we designed this study to compare hospital outcomes of intentionally injured patients presenting to a tertiary ICU compared to unintentional injuries.

Methods: The regional trauma database was interrogated to produce two datasets that included all adult trauma patients admitted to the Alfred Intensive Care Unit between 01/07/2002 and 30/06/2007. The first included patients that sustained intentional injuries, the second comprised un-intentional injuries and acted as a control group. Logistic regression was used to model factors associated with mortality.

Results: Intentionally injured patients made up 4.17% of the total burns, blunt and penetrating trauma admissions to the Alfred ICU over the five-year study period. There was a trend towards higher mortality overall and in all subgroups of patients with intentional injuries when compared to those with unintentional mechanisms of injury. After adjusting for injury severity and age, a mechanism of injury involving intentional injury was independently associated with a doubling of the odds of death.

Conclusions: Our study is the first paper in the literature to describe an increased risk of death within a group of patients admitted to a trauma and burns ICU following deliberate self-harm.

© 2011 Elsevier Ltd. All rights reserved.

Introduction

Patients with mental illness or depression may sustain self-inflicted injuries that require admission to an Intensive Care Unit (ICU). These include burns, deliberate drug overdoses and trauma. Frequently the management of these injuries requires extended ICU stays and/or multiple admissions. Similarly the care of major burns patients within an ICU is physically and emotionally demanding on the medical staff. There is limited data in the literature regarding the outcomes of these patients. It is unknown whether the intent of injury leads to a greater likelihood of dying over and above the severity of the initial trauma or burn itself.

In 2007, suicide was the 15th most common overall cause of death in Australia, and the 10th most common amongst males. Although suicide accounted for only 1.4% of the total deaths, the human and economic costs are significant, as it typically affects younger, economically productive adults – the median age of suicides in Australia in 2007 was 41.7 years for males and 44.5 years for females. Additionally, coroner’s reports typically underestimate suicide, where cause of death is uncertain, which means that these figures are most probably an underestimate. As such it is an area worthy of research.

Given the significance of the burden of injury caused by intentional injuries, we designed this study to compare hospital outcomes of intentionally injured patients compared to unintentional injuries. Our aims were to identify an intentionally injured ICU population from pre-existing datasets, and assess the impact of self-harm on outcome amongst patients presenting to a tertiary ICU with traumatic and burns injuries.

The use of anonymised data in this study was approved and provided by the Victorian State Trauma Outcome Registry and Monitoring Database (VSTORM). VSTORM obtained full ethical committee approval from each hospital contributing to the registry before data collection commenced from that institution.

Patients and methods

The Alfred is a major tertiary referral hospital in Melbourne, Australia. It provides a wide range of specialist services including
burns, cardiothoracic surgery, neurosurgery and hyperbaric medicine. It is one of two designated adult trauma centres in the state of Victoria. It has one of the largest Intensive Care Units in Australia with approximately 2000 admissions a year.

The Victorian State Trauma Outcome Registry and Monitoring Database (VSTORM) is managed by Monash University and funded by the Victorian Department of Human Services and the Transport Accident Commission. It was established in order to allow monitoring of the state trauma system and captures data on all major trauma within the state of Victoria. It was developed in order to improve trauma care within the state. It contains data on the circumstances of the injury, demographics of the patient, admitting hospital and length of stay, Injury Severity Score (ISS) and mortality. Since July 2005 it has started collecting Glasgow Outcome Score – extended (CoSe) data at 6 and 24 months post injury, and Short Form mental and physical scores, however this data was incomplete at the time of this study and therefore not used.

The VSTORM database was interrogated to produce two datasets that included all adult trauma patients admitted to the Alfred who required admission to Intensive Care Unit between 01/07/2002 and 30/06/2007. The first included cases coded as intentional injuries (otherwise known as deliberate self-harm or an incomplete suicide attempts.) The second included all cases coded as un-intentional injuries and acted as a control group. These datasets included details of the injury, the mode of trauma (blunt, penetrating or hanging) age, sex, date of admission, length of hospital and Intensive Care stay, outcome, discharge date and Injury Severity Score. This data was then analysed with descriptive statistics.

All analyses were performed using Intercooled STATA version 9.2 (StataCorp, College Station, Texas 77845, USA). Univariate comparisons were performed with Chi square tests for categorical variables, t-tests for parametric data and Wilcoxon tests for non-parametric data. Parametric data are presented as mean (±SD). Non-parametric data are presented as median (IQR). Logistic regression (with backwards and forwards selection procedures) was used to model factors associated with mortality. No interactions were detected between the presence of intentional injury and age or injury severity. Individual modes of injury were entered as categorical variables into the analysis. Results are presented as odds ratios with

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Baseline characteristics. SD, standard deviation; LOS, length of stay; IQR, inter-quartile range; ICU, Intensive Care Unit; ISS, Injury Severity Score.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentional injury</td>
<td>Unintentional injury</td>
</tr>
<tr>
<td>Total patients</td>
<td>98</td>
</tr>
<tr>
<td>Mortality</td>
<td>22 (22.4%)</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>38.65 (13.3)</td>
</tr>
<tr>
<td>Male</td>
<td>55 (59.1%)</td>
</tr>
<tr>
<td>Median LOS days (IQR)</td>
<td>16.8 (7.2–39.1)</td>
</tr>
<tr>
<td>Median ICU days (IQR)</td>
<td>5 (2–12)</td>
</tr>
<tr>
<td>Mean ISS (SD)</td>
<td>28.8 (17.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Multiple logistic regression analysis for variables independently associated with mortality. ISS, Injury Severity Score.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentional injury</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Hanging</td>
<td>1.79</td>
</tr>
<tr>
<td>Age</td>
<td>1.04</td>
</tr>
<tr>
<td>ISS</td>
<td>1.06</td>
</tr>
</tbody>
</table>

* Odds ratio for modes of injury were referenced against blunt trauma patients, the largest group. Modes of injuries involving either burns or penetrating trauma were not significantly associated with mortality.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>ICU and hospital length of stay for deaths. LOS, length of stay; IQR, inter-quartile range.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentional injury</td>
<td>Non-intentional injury</td>
</tr>
<tr>
<td>Median ICU LOS/days (IQR)</td>
<td>5 (1–12)</td>
</tr>
<tr>
<td>Median hospital LOS/days (IQR)</td>
<td>17.5 (6.8–44.9)</td>
</tr>
</tbody>
</table>

95% confidence interval. Two sided P values <0.05 were considered significant.

Results

A total of 98 patients intentionally injured patients and 2251 unintentionally injured patients were identified from the VSTORM database. This data was collected on patients injured between 1st July 2002 and 30th June 2007. Intentionally injured patients made up 4.2% of the total burns, blunt and penetrating trauma admissions to the Alfred ICU over the five-year study period. The baseline characteristics of these groups are shown in Table 1.

Of the intentional injury group, 20 (20.4%) sustained burns, 45 (45.9%) blunt trauma and 28 (28.6%) penetrating trauma. In comparison, of the unintentionally injured group, 160 (7.1%) sustained burns, 2010 (89.2%) blunt trauma and 69 (3.0%) penetrating trauma. There were no accidental hangings in the unintentionally injured dataset. The injury mode was unrecorded in 12 (0.5%) patients. Further data regarding these groups is found in Table 2. There was a trend towards higher mortality overall and in all subgroups of patients with after intentional injuries when compared to those with un-intentional mechanisms of injury.

A multiple logistic regression analysis was conducted to analyse the association of age, ISS, mode of injury and intentional injury with mortality and is found in Table 3. After adjusting for injury severity (ISS), age and mode of injury, the presence of intentional injury was independently associated with a near doubling of the odds of death (OR 1.79, P = 0.041). There was no significant difference in either hospital or ICU length of stay for those patients that died from intentional or unintentional injuries (Table 4).
Discussion

Our study showed that although accounting for less than 5% of all trauma admissions to the Alfred Hospital ICU, a mechanism of injury involving intentional injury was independently associated with a doubling of the odds of death. This increase in mortality was seen across all forms of intentional injury – burns, blunt and penetrating trauma. The higher risk of death intentional injury entails was still seen after accounting for the potential confounding effect of hanging. Although not quite reaching statistical significance at a univariate level, intentional injury was identified as an independent significant predictor of death after adjusting for age and injury severity. Of injury modalities, only hanging was independently associated with mortality. For the remaining injury types (blunt trauma, penetrating trauma and burns) the patient age, ISS and if the injury was intentional were predictive of death.

Patients who sustained intentional injury were younger and more likely to be female than those with unintentional injuries. However, the intentional injury patients did not have a significantly different length of hospital or ICU stay, nor degree of injury as defined by the Injury Severity Score.4 There are several possible explanations for the increased mortality within the intentionally injured group. Firstly, self-inflicted burns tend to be more severe as the patients’ overall make less concerted efforts to put the flames out or are less likely to be assisted as they may have tried to conceal their attempt at suicide. In addition, self-inflicted burns are more likely to involve the head, neck and upper torso as accelerant is poured over themselves, in contrast to accidental burns victims who will try and protect these areas. Equally, self-inflicted gunshot wounds are sustained at close range and therefore are potentially of a higher energy and associated with a greater degree of contamination. Secondly, it may be that the intentionally injured populations are subject to prejudice about their medical care, either through pessimistic views on their long-term outcome, or prejudicial views about mental health issues. This could manifest in a variety of ways that ultimately results in a higher mortality. For example clinicians making decisions on level or duration of organ support may decide to withhold additional treatment or withdraw support earlier if they believe that the patient is unlikely to survive or subsequently make a further attempt on their life should they recover to hospital discharge. As individual clinicians are commonly under pressure to ration scarce ICU resources, consciously or subconsciously they may be more likely to withdraw care or not escalate support on patients who have been intentionally injured. Furthermore, a significant proportion of those patients that sustain intentional injuries have chronic medical health problems. Such patients can become socially isolated, and so may lack advocacy from relatives or friends when discussions regarding treatment limitation or withdrawal are made. Accordingly, it may be easier for clinicians to limit or withdraw ICU care to this patient group. In addition, our study reflects a single centre experience, so there may be institutional factors that lead to prejudicial care of the intentionally injured. However, analysis of length of stay of those patients that died in our study fails to support this argument, as no significant differences were seen in either hospital or ICU length of stay between the intentionally injured and accidentally injured groups.

Thirdly, it may be that the morbidity sustained by the intentionally injured group is not well described by the ISS, and so underestimates their degree of injury and therefore their risk of mortality. The abbreviated injury scale (AIS)3 from which the ISS is derived, is a simple scoring system with each anatomical region being assigned a score from 0 to 6, 6 being defined as an unsurvivable injury. All body regions have the same weighting. Only three regions are included and only one injury per region is considered. Clearly, a serious head injury has a greater impact on risk of death than a serious injury to an extremity. The ISS takes no account of physiological variables and as the AIS scores are squared to produce the ISS, any error in scoring will be magnified with the multiplication. Risk adjustment using the Trauma Injury Severity Score (TRISS),4 an alternative trauma scoring system (which includes a weighting from physiological variables) was not possible in our study. Although useful for the analysis of blunt trauma, TRISS values are not applicable to burns and hangings, mechanisms heavily represented in the intentional injury group. As a result 27% of the intentional injury group did not have TRISS probabilities versus 8% of the unintentionally injured dataset, which would have lead to an unacceptable level of bias in our analysis. Those without a TRISS score had a higher mortality than those who did.

Finally, those patients that sustained intentional injuries are more likely to have a worse mental state post injury, and potentially therefore be less motivated or compliant with aspects of their recovery and rehabilitation. Additionally they may decline further necessary treatment.

Excess mortality and repeated suicide attempts

Cusick et al.5 performed a five-year review of self-injured patients admitted between 1990 and 1994 at a level 1 trauma centre in Kansas. They found that traumatic suicide attempts comprised 3.4% (91 patients) of their trauma admissions, similar to the 4.2% in our study, with an average age of 33.6 years (38.7 Alfred). Overall 57.1% (52) patients survived the index attempt (77.6% our experience). Three of these subsequently died within the follow up period, 2 were confirmed as suicide. All of these patients were defined as having chronic mental illness (defined as chronic depression, schizophrenia, bipolar or personality disorders).

Other authors have described a similar excess mortality associated with attempted suicides, albeit over a longer time frame. Ostamo et al.6 performed a study looking into the excess mortality of 2782 suicide attempters that had a mean follow up period of 5.3 years in Helsinki. They found that males had a mortality rate that was fifteen times that expected, females had a nine times expected mortality. Overall, 15% of suicide attempters died during the study period. Suicidal deaths accounted for 37% of the male excess deaths, 44% of the female. However, this still leaves a majority of excess deaths unaccounted for.

Beautrais7 performed a similar study in New Zealand. During their five-year follow up, 8.9% had died, 59.2% by repeated suicide and a significant part of the remainder by road traffic accidents.

Functional outcomes

Our study was unable to provide data on long-term functional outcomes after traumatic suicide attempts that required intensive care treatment. In 2005 Pajonk et al.8 published a paper that investigated long-term mortality and functional outcome after suicide attempts that were admitted to a level 1 trauma centre in Germany. The patients had sustained severe multiple blunt trauma and had a mean ISS 40 (SD15), compared to our patients ISS of 28 (SD17). Their follow up period was between 3 and 9 years post injury. Ninety per-cent of the subjects had a psychiatric diagnosis at the time of the index attempt. Overall 32% died during their hospital stay, higher than our 22.4%. At follow up examination, 48% had ‘good outcomes’, reflected in absent or ambulatory psychiatric treatment, employment, a normal psychiatric examination and good psychosocial ability. None had re-attempted suicide. They found that a diagnosis of schizophrenia, continued psychiatric treatment and a lack of employment were associated with a poor outcome.
Ruchholtz et al. performed a similar study and concluded that the overall quality of recovery was approximately 20% worse than in a unintentionally injured cohort, and this difference could be attributed to the underlying chronic psychiatric disease.

Burns

In contrast to the better than expected outcomes following traumatic suicide attempts reported in the literature, patient recovery from deliberate burns is significantly worse. Klasen et al. studied 57 patients who between them had 68 suicide attempts. Most of them had serious psychiatric problems, overall 12 died (21%, Alfred experience 30% mortality). Of the 45 initial survivors, at a mean follow up period of 3.8 years; 8 had died, 13 were resident at a psychiatric hospital, 3 were in prison and a further 3 were living in a protected environment. Only 18 (31.6%) were living at home with any functional capacity.

Ali et al. looked at their self-injured burns experience in 2006. Over a 5-year period their institution admitted 1656 burns patients in total. Of these, 56 (3.5%) were intentional. They had an average age of 36, with more female patients overall. The average hospital length of stay was 22 days (similar to our experience of 27.8 days.) Their mortality for intentional burns of 25% versus 3% for non-intentionally burnt was lower than our experience (30% versus 13.8% Alfred experience), however their data reflected total hospital burns admissions, whereas our data are of the more severely injured ICU patients. Of their self-inflicted burn admissions the majority (47%) had a history of self-harm and 39% required ICU admission versus 4.3% of the standard burns over the study period. Additionally, amongst this intentionally burnt group, one quarter had a repeated episode of self-harm.

Limitations

It is likely that this study has underestimated the number of self-injured patients, as un-witnessed injuries will rely on the patient’s self-reported intent. For example, a single vehicle accident with only a driver and no passengers may have been a suicide attempt, but will rely on the individual surviving and reporting the incident as an attempt at suicide.

At the time of this study, the VSTORM database was not collecting APACHE II or III data and therefore a more detailed physiological analysis was not possible. Similarly, burn surface area or other details were not recorded and therefore we were unable to calculate Baux scores or adjust for smoke exposure. The VSTORM database has developed further and therefore these issues could be addressed in a follow up study.

The VSTORM database has begun routinely collecting GOSe data at 6, 12 and 24 months for all trauma admissions. Long-term data was unavailable at the time of this study and therefore we lack data on the functional recovery and health-related quality of life of these patients.

To our knowledge, this study is the only one in the literature exclusively investigating self harm amongst a population of ICU patients. Therefore, comparison with other literature is problematic, as typically they have investigated a mixed ward based and ICU population.

Our study is the first paper in the literature to describe an increased risk of death within a group of patients admitted to a trauma and burns ICU following deliberate self-harm. We believe this is a significant and unexplained finding that deserves further study, particularly as this patient group is typically younger and potentially economically active.

Future studies using ICU specific mortality prediction models such as the Acute Physiology and Chronic Health Evaluation (APACHE) and more sophisticated trauma scoring systems may allow more detailed analysis to be made. Equally, with the capture of GOSe data, further study will be able to address the question of functional recovery in this socially and economically important patient group over the medium to long term.

Conflict of interest statement

There are no conflicts of interest.

Acknowledgements

Many thanks to Andrew Hанныfard and Edward Chow and the VSTORM registry, Department of Epidemiology, Monash University.

References