How self-inflicted injury and gender impacted the outcome following a severe burn

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ABSTRACT

Background: A high prevalence of self-inflicted burn injury is noted in severe burn injury. It remains unclear as to whether gender and past psychiatric history impact upon whether injury is self-inflicted and the outcomes.

Aims: Review the psychiatric history of patients treated in a statewide burn service following severe burn injury and determine whether psychiatric history, extent of burn and mortality are impacted by gender and whether the injury was self-inflicted.

Method: A data linkage study was performed with psychiatric history and mental health service contact data matched to patients' data collected via a previous retrospective file audit. Unadjusted and adjusted logistic regression modelling measured interactions between gender and self-inflicted burn status, and other study outcomes.

Results: In total, 298 patients (47 with a self-inflicted burn) were admitted following a severe burn. Patients with self-inflicted burns were significantly more likely to have total body surface area burn of at least 50% (OR=9.3; 95%CI: 4.7–18.5) and die within 24h of admission (OR=10.5; 95%CI:4.7–23.2). They were significantly more likely to have a past psychiatric diagnosis and public mental health service contact in the month pre-injury (OR=18.9; 95%CI: 7.5–47.2). Male patients had significantly lower rates of a psychiatric diagnosis and recent mental health service contact. Males with self-inflicted injury are far more likely to die than males with a non-self-inflicted injury.

Conclusions: Psychiatric clinicians should assertively screen the psychiatric history of patients with severe burn injury, and participate in the acute and longer-term management of persons admitted with a self-inflicted burn.

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1.   Introduction

Self-inflicted burn injuries may occur in the context of either deliberate self-harm or attempted suicide. Intentional injuries are associated with serious physical, psychological and social challenges for the patient, their family and the community [1], and pose a significant medical problem worldwide [2].

Previous research has found that only 1.5% of all burn injuries in Victoria, Australia, were intentional [3]. This finding was consistent with numerous international studies suggesting that self-immolation contributes to 1–6% of all burn injuries in developed countries [2,4–7]. However, when examining patients with a severe burn injury, this rate increases dramatically, with prevalence of self-inflicted burn injury in developed countries contributing 5.5–10.3% [8,9]. In areas such as the Middle East and South Asia, self-inflicted burn injuries account for over 25% of admissions to burns units, and represent a major cause of extensive burns and burn-related mortality [9–15].

The prevalence, cause and outcomes following severe self-inflicted burn injury warrants further investigation. Previous research indicates that self-inflicted burn injuries are associated with a higher %total body surface area burn (TBSA) than accidental injuries. However, studies often examined risk factors associated with severe burn injury, without stratifying the severity of the burn sustained [6,8,16,17]. Previous diagnosis of a psychiatric disorder has been identified as a risk factor for a self-inflicted burn [16]. It has been suggested that psychiatric comorbidity, including psychosis and major mood disorders, impacts upon the recovery from severe burn injury, however there remains a paucity of research examining the comorbid mental illness in patients with a severe burn injury [18].

Psychiatric comorbidity is frequently present in persons with a self-inflicted burn injury. George et al. [19] found that 85.7% of those admitted following a self-inflicted burn were known to a psychiatric service prior to injury. However, the presence and nature of contact with mental health services in the weeks prior to the burn injury has rarely been investigated. A burn injury occurring despite active mental health service contact, may reflect a missed opportunity to identify and respond to clinical factors contributing to the injury occurrence.

An additional factor to consider is gender. While findings are somewhat inconsistent, recent research has found gender differences in mortality rate [20–22] and post-hospital recovery following burn injury, with female patients experiencing poorer outcome [23]. Gender differences have also been identified in rates of self-harm (higher in females) and suicide (higher in males) [3,15], highlighting gender as an important variable to consider when examining the nature and outcomes of self-inflicted burn injury.

As shown above, identified gaps in the existing literature include a lack of clarity regarding whether and how psychiatric history and self-inflicted injury impacted upon severe burn outcome, and whether this interacted with gender. It also remains unclear as to what the nature of contact with psychiatric services was immediately prior to a severe burn injury occurring. To address this identified gap in the literature, we measured the prevalence of self-inflicted burn injury in a sample of patients with severe burn injury and

tested the following hypotheses. It was hypothesised that self-inflicted burn injury patients would be more likely to have a psychiatric diagnosis, recent mental health service contact, more extensive burn injury and greater risk of mortality. It was further hypothesised that female patients would be more likely to display a psychiatric history and have higher rates of self-inflicted injury. Finally, we hypothesised that male patients with self-inflicted injuries would be more likely to die than males with non-self-inflicted injury, whereas mortality rate for female patients would not differ based on intent of injury. Through testing these hypotheses, we aimed to improve the ability to identify patients who are at risk of severe self-inflicted burn injuries, and to better meet their clinical and psychiatric needs.

2.   Methods

2.1.   Setting

The estimated resident population of Victoria at June 2015 was 5.94 million people. The capital city, Melbourne, has 4.53 million people, accounting for 76% of Victoria's population [24]. The Victorian Adult Burns Service at the Alfred Hospital is the sole specialist adult burns centre for the state of Victoria, Australia. Each year it admits over 300 burns patients and treats over 1000 outpatients [24].

2.2.   Design and patients

This data linkage study matched psychiatric history and mental health service contact data held and provided by the Victorian Government Department of Health and Human Services to data for patients collected via a previously conducted retrospective file audit [25–27]. The previously conducted audit study included all patients admitted to the VABS between January 1st 2003 and December 31st 2012 with a burn injury greater than or equal to 20% TBSA. Patients admitted with other desquamating skin conditions such as toxic epidermal necrolysis and those who presented to VABS more than 24h after burn injury were excluded. During the study period, 316 patients were admitted to the VABS with a burn injury of at least 20% TBSA. Nine were excluded as they were transferred to The Alfred >24h following their burn injury, and nine were excluded due to inadequate details regarding the nature of the injury, the intent of injury or the file not being available. This resulted in a study population of 298 patients.

2.3.   Procedure and measures

The study was reviewed and approved by the Alfred Hospital Ethics Committee (approval number 378/16) prior to commencement. The initial audit involved a retrospective chart review of patient records. Patients were identified through departmental records and a separate search via the Burns Registry was undertaken and cross-referenced for quality control. Data was extracted from medical records pertaining to patient demographics, including age and gender of the patient and the nature of the burn injury including %TBSA and mechanism of injury. Following review of the file, author HD

coded the intent of burn injury as 1 for intentional injury and 0 for non-self-inflicted injury. Non-self-inflicted burns included both accidental injury and burn following an assault. Outcomes including length of hospital stay and mortality were recorded.

A request for data was made to the Centre for Victorian Data Linkage at the System Intelligence and Analytics Branch. This request included mental health diagnosis and public mental health service contact data held by the Victoria Government Department of Health and Human Service, including compulsory status under the Mental Health Act (27, 28) at the time of injury. This request was made to the Centre for Victorian Data Linkage at the System Intelligence and Analytics Branch. The request was accompanied by a copy of the Alfred Hospital Ethics Committee approval certificate and ethics review application. To facilitate data sharing, the hospital unit record number, date of birth and date of burn injury was uploaded to the Secure Data Exchange held by the Department of Health and Human Services. Patients were assigned a study patient code by the Centre of Victorian Data Linkage. Following data linkage, a spreadsheet containing the requested data was obtained and merged with previously collected data.

2.4. Analysis

Analysis was performed using IBM SPSS Statistics 25. Normally distributed continuous data are reported as mean with standard deviations, whereas skewed or ordinal data are reported as medians with inter-quartile ranges. Univariate (unadjusted) logistic regression was used to measure whether gender or self-inflicted burn injury status altered the odds of key demographic, burn-specific and psychiatric variables occurring. Continuous variables were categorised into binary variables to enable use as dependent variables in these analyses. Burn size (%TBSA) was clustered into 1=50 or greater; 0=less than 50, and age was clustered into 1=50 or greater; 0=less than 50. Multivariable (adjusted) logistic regression analyses were also conducted in which self-inflicted injury status, gender and the interaction were simultaneously included to examine whether the observed relationships remained significant after adjustment and whether the interaction impacted upon the study outcomes.

3. Results

Within the included sample of 298 patients with a severe burn injury, 47 patients (15.4%) were recorded as having a self-inflicted burn injury. The profile, including demographics of patients admitted, are summarised in Table 1. Of particular note in relation to the patients with a self-inflicted burn, 18 (38.3%) had contact with a public mental health service in the month prior to their injury, and 5 (13.9%) were managed as compulsory patients under the Mental Health Act at the time of injury.

Table 1 – Comparison of self-inflicted versus non-self-inflicted burn injuries in total sample and by gender.

	Total		Male		Female	
	Self-inflicted (n=47)	Non-self-inflicted (n=251)	Self-inflicted (n=28)	Non-self-inflicted (n=184)	Self-inflicted (n=19)	Non-self-inflicted (n=67)
Demographic and clinical						
Male gender: n (%)	28 (59.6%)	184 (73.3%)				
Age: mean (SD)	41.9 (13.1)	45.8 (19.9)	44.7 (13.8)	44.4 (19.0)	37.8 (11.1)	49.6 (22.0)
Flame as burn mechanism: n (%)	46 (95.8%)	207 (82.5%)	28 (100%)	155 (84.2%)	18 (94.7%)	52 (77.6%)
%TBSA: mean (SD)	65.8 (27.9)	35.4 (19.0)	71.0 (26.3)	36.0 (18.9)	50.8 (26.2)	33.7 (19.2)
Hospital LOS (days median, IQR)	28 (0–75)	28 (14.5–44)	7.5 (0–65.3)	23.5 (14–41)	39 (13.5–81)	33 (19.5–48)
Mortality (within 24h of injury)	18 (38.3%)	14 (5.6%)	13 (46.4%)	11 (6.0%)	5 (26.3%)	3 (4.5%)
Mortality (during admission)	24 (51.1%)	41 (15.9%)	17 (60.7%)	26 (14.1%)	7 (36.8%)	14 (20.9%)
Psychiatric: n (%)						
Any psychiatric diagnosis	31 (66%)	31 (12%)	15 (53.6%)	15 (8.2%)	16 (84.2%)	16 (23.9%)
Any personality or affective disorder	13 (27.7%)	15 (6.0%)	4 (14.3%)	6 (3.3%)	9 (47.4%)	9 (13.4%)
Psychotic disorder	9 (19.1%)	8 (3.2%)	5 (17.9%)	4 (2.2%)	4 (21.1%)	4 (6.0%)
Substance use or other disorder	10 (21.3%)	8 (3.2%)	6 (21.4%)	5 (2.7%)	4 (21.1%)	3 (4.5%)
CATT in month prior	7 (14.9%)	1 (0.4%)	4 (14.3%)	0 (0%)	3 (15.8%)	1 (1.5%)
Triage in month prior	8 (17.0%)	1 (0.4%)	3 (10.7%)	0 (0%)	5 (26.3%)	1 (1.5%)
Contact with MHS in month prior	18 (38.3%)	8 (3.2%)	8 (28.6%)	3 (1.6%)	10 (52.6%)	5 (7.5%)
Compulsory treatment at injury	5 (10.6%)	1 (0.4%)	3 (10.7%)	0 (0%)	2 (10.5%)	1 (1.5%)

CATT=crisis, assessment and treatment team; MHS=mental health service; TBSA=total body surface area.

Table 2 – How self-inflicted burn status and gender altered the odds of clinical psychiatric variables occurring.					
	Unadjusted OR (95%CI) for self-inflicted burn	Unadjusted OR (95%CI) for male gender	Adjusted OR (95%CI)[a]		
			Self-inflicted burn	Male gender	Self-inflicted x gender
Demographic and clinical					
Age $\geq$50	0.8 (0.4–1.6)	1.0 (0.6–1.7)	0.1 (0.0–0.6)[*]	0.7 (0.4–1.2)	14.3 (2.5–81.0)[*]
%TBSA $\geq$50	9.3 (4.7–18.5)[*]	1.5 (0.8–2.8)	7.7 (2.3–25.4)[*]	1.9 (0.8–4.7)	1.8 (0.4–8.1)
Mortality (within 24h of injury)	10.5 (4.7–23.2)[*]	1.2 (0.5–2.9)	7.5 (1.6–35.1)[*]	1.3 (0.4–4.9)	1.8 (0.3–11.2)
Mortality (during admission)	5.5 (2.8–10.7)[*]	0.8 (0.4–1.4)	2.2 (0.7–6.7)	0.6 (0.3–1.3)	4.3 (1.0–17.3)[*]
Psychiatric					
Any psychiatric diagnosis	13.8 (6.8–28.0)[*]	0.3 (0.2–0.5)[*]	17.0 (4.4–65.9)[*]	0.3 (0.1–0.6)[*]	0.8 (0.1–3.9)
Any personality or affective disorder	6.0 (2.6–13.7)[*]	0.2 (0.1–0.4)[*]	5.8 (1.9–18.2)[*]	0.2 (0.1–0.6)[*]	0.9 (0.1–4.9)
Psychotic disorder	7.2 (2.6–19.8)[*]	0.4 (0.2–1.2)	4.2 (0.9–18.7)[*]	0.4 (0.1–1.4)	2.3 (0.3–17.9)
Substance use or other disorder	7.3 (2.8–19.1)[*]	0.7 (0.3–1.8)	5.7 (1.2–28.2)[*]	0.7 (0.2–3.0)	1.4 (0.2–10.6)
Contact with MHS in month prior	18.9 (7.5–47.2)[*]	0.3 (0.1–0.6)[*]	13.8 (3.8–49.6)[*]	0.2 (0.0–0.9)[*]	1.8 (0.3–11.7)

MHS=mental health service; OR=odds ratio; TBSA=total body surface area.
[*] $p<0.05$.
[a] Multiple logistic regression model with self-inflicted burn status, gender and their interaction as covariates.

Extent of injury (%TBSA) was larger in patients with self-inflicted burn injury and, as shown in Table 2, there was a significantly increased odds of the burn being at least 50%. Patients with self-inflicted burns were also significantly more likely to die within 24h of admission, or during admission, to have a psychiatric diagnosis, and to have had contact with a mental health service within the 1month prior to injury. As only one patient with non-self-inflicted injury had contact with mental health crisis responses services or was subject to a compulsory treat order, a statistical comparison was not made. However, patients with self-inflicted injury were observed to have had higher rates of contact with these services or being under compulsory mental health treatment.

More males in the sample had experienced a severe burn injury. A chi-square test of independence was conducted to examine whether the prevalence of injury being self-inflicted differed by gender. While a trend was evident for more females experiencing a self-inflicted injury, this relationship was not significant ($\chi^2(1)=3.64$, $p=0.057$). Gender was not significantly related to age, extent of injury or mortality, although female patients were significantly more likely to have any psychiatric diagnosis (in particular a personality or affective disorder) and to have had contact with a mental health service in the month prior to injury.

After covarying for self-inflicted injury status, gender and the interaction, significant interaction effects were evident for age and mortality at any time during admission. As shown in Table 1, age did not differ between males with self-inflicted or non-self-inflicted injury, but female patients with self-inflicted injury were younger. Males with self-inflicted injury had a far greater mortality rate than males with non-self-inflicted injury, whereas there was little difference in mortality rate for female patients with self-inflicted or non-self-inflicted injury. Of further interest, independent of whether the injury was self-inflicted, female patients were significantly more likely to have any psychiatric diagnosis, a personality disorder

or affective disorder diagnosis, and to have had contact with a public mental health service in the month prior to injury.

4. Discussion

This study examined the prevalence of self-inflicted burn injury in a population of patients with a severe burn injury. It further explored the presence of psychiatric diagnosis and contact with public mental health services in the month prior to injury for persons with both intentional and non-intentional burn injuries. Self-inflicted burn injury represented a large proportion of patients admitted with severe burn injury (15.4%), and higher than previously reported rates of 1.5–2.2% identified within samples in which all burns are included [3,16]. Self-inflicted injuries were associated with larger burns, a higher rate of mortality and increased rate of comorbid psychiatric diagnosis.

Consistent with previous research, self-inflicted burns were significantly larger and were associated with a significantly increased risk of mortality during the admission [28]. Over half the patients admitted following a self-inflicted burn succumbed to their injury. This relationship was particularly pronounced in male patients with self-inflicted burns, who were admitted with a larger injury and a significantly higher rate of mortality. Self-inflicted burn injuries may occur in the context of either deliberate self-harm or attempted suicide. It could be suggested that, as demonstrated in previous research, this difference in mortality is due to male patients being more likely to attempt suicide via self-immolation, whereas female patients are more likely to engage in deliberate self-harm [15].

Previous research has identified a high prevalence of major psychiatric illness in those presenting with a severe, self-inflicted burn injury [29,30]. In this study, the prevalence of psychiatric diagnosis in those with a self-inflicted burn was 66%, compared with 12% in those admitted following a non-

self-inflicted injury. The high morbidity and mortality in the self-inflicted burn group highlights the importance of specialist burn services assertively screening the psychiatric history in patients with severe burns, and facilitating access to psychiatric support.

Consistent with previous research, a large proportion of patients with self-inflicted burns had contact with public mental health services in the month prior to injury, including over 50% of female patients with intentional injuries [19]. This included five patients who were subject to compulsory treatment at the time of their injury. It has been well established that a prior history of deliberate self-harm is a strong predictor of further self-harm [31]. Psychiatric services caring for patients at risk of deliberate self-harm using flame must therefore carefully monitor and intervene when escalating and imminent risk is identified. Given the potential seriousness of self-immolation as a mechanism for deliberate self-harm, the importance of engaging psychiatric clinicians in the management of these patients cannot be overstated, including in the development of psychiatric management plans with the aim of lessening the risk of future burn injury.

It is also worth considering the impact that psychiatric illness may have upon physical and psychological recovery from a major burn injury. The rate of psychiatric diagnosis was higher in patients with a severe burn injury than that of the general population. The Australian National Survey of Psychosis [32] suggested that 0.5% of the Australian population lives with a psychotic illness. In this study, 3.2% of patients admitted with a non-self-inflicted injury had a diagnosis of schizophrenia, including 6% of female patients. The presence of a psychosis diagnosis may therefore be a risk for increased burn severity, independent of whether a burn was intentional. Caine et al. [18] also found in a sample of 118 patients with a self-inflicted burn that only 36% of patients attended their initial outpatient burns clinic appointments following discharge from hospital. With 36% of 102 surviving patients also receiving community or hospital psychiatry care following burn admission discharge, it is likely that the presence of acute psychiatric symptoms complicated burn injury follow-up, demonstrating the complexity of post-operative care in this patient group. It suggests the need for more assertive follow-up of patients admitted with a self-inflicted burn injury and makes a compelling argument for psychiatric clinicians being involved in the longer-term care of these patients.

There were a number of limitations associated with this study which should be considered when interpreting the findings. There are inherent limitations associated with both a data linkage study and retrospective research including incomplete data and recorder bias. Severe burn injury remains a rare event, reflected in small numbers of self-inflicted injury. Additionally, we were unable to comment on the contact that patients had with private mental health services or primary care clinicians for treatment of mental illness or diagnoses given in these settings. This may underestimate the support that patients sought prior to a self-inflicted injury, or the extent of psychiatric history.

This study has demonstrated a high prevalence of self-inflicted burn injury and major mental illness in patients with severe burn injury, and a significantly increased risk of mortality following a self-inflicted burn. This highlights the role of psychiatric clinicians in assertively screening the psychiatric history in patients with severe burns, and in the acute and long-term management of persons admitted with a self-inflicted burn.

Declarations of interest

None.

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