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Burns inflicted by self or by others—An 11 year snapshot

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ARTICLE INFO

Article history:

Accepted 10 April 2006

Keywords:

Assault
Self inflicted
Burn injury
Suicide

ABSTRACT

Introduction: In the United Kingdom, the incidence of assault by burning and of self inflicted burns increased significantly over the last decade. This has major implications both for service providers and society as a whole. Our aim was to investigate the differences in patients' characteristics, management and outcome following a burn sustained by either an assault or self immolation.

Methods: Acute admissions to a tertiary Burn Centre were retrospectively reviewed over an 11 year period (1994–2005). Demographic data and information regarding the circumstances surrounding the incident, burn severity, treatment and outcomes of the patients were collected.

Results: Over an 11 year period, 1745 patients were admitted to the tertiary Burn Centre. Of this total, 41 patients (mean age 29 years \pm 16) sustained burns following an assault, a further 86 patients (mean age of 37 years \pm 12) had self inflicted burn injuries; males were preponderant in both groups. In this series, a history of alcohol or substance abuse was present in 25% of both cohorts, 63% of the patients with self inflicted injuries having a previously diagnosed psychiatric disorder.

Petrol, accelerants and other flammable liquids were the main agents chosen to inflict injury in both the assault and self inflicted groups.

The burn depth and surface area distribution was greater in the self inflicted group compared to those assaulted (29% versus 21%). A difference was also noted in the pattern of distribution of burns between the two groups, as well as between genders although this difference was not significant. Two-thirds (67.4%) of the self immolated patients and 56% of the assaulted group required surgery.

The length of hospital stay was similar for both groups, averaging 20 days. The crude mortality for the self inflicted group was 29%, whereas in the assaulted patients, the overall mortality was 4.9%.

Conclusion: Although the incidence of burns caused either by assault or attempted suicide is low, the affected patients require a multidisciplinary approach. Their management requires significant medical, psychological occupational and social support. Increased awareness and education of those vulnerable individuals maybe of benefit to help prevent self inflicted injuries by burning.

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doi:10.1016/j.burns.2006.04.008

1. Introduction

Non-accidental severe burns represent a significant social and medical problem in economically developed and developing countries. Assault and self immolation are two mechanisms of burning classified as non-accidental injuries, both attracting forensic considerations.

Self inflicted burns may be an attempt at suicide (self immolation) or part of a continual urge towards the deliberate self harm process [1]. These injuries are commonly associated with previous psychiatric disorders or predisposing factors such as: alcohol, substance abuse, relationship discords, unemployment and emotional trauma [1].

In Western culture, previous studies have reported frequencies of self inflicted injuries by burning from <0.5 to 2% under the age of 18 years, in adults the incidence being estimated as high as 25% of the total burn admissions [1-6]. In Asia (Iran, India, Iraq), the incidence is higher, with previous papers reported rates between 9 and 32%. Retrospective studies reported no gender difference [1], while others have shown a preponderance of self immolation in women of Asian and Latina origin.

In the United Kingdom, from a forensic point of view, assault by burning may become actual or grievous bodily harm, manslaughter or even murder [1]. Different types of severe burns are associated with the underlying motives of the assailant [12]. The rehabilitation period is relatively difficult due to significant loss of function. Common outcomes include depression, post-traumatic stress disorders, unemployment and isolation from society.

The aim of this study was to review the incidence, characteristics, management and outcome of self inflicted and assault burn injuries from a single Regional Burn Centre in the UK.

2. Material and methods

A retrospective study was undertaken of all acute admissions to a tertiary Burn Centre in Yorkshire between January 1994 and December 2004. Pinderfields Regional Burn Centre serves a population of about 3.5 million inhabitants with a catchment area that includes East, West, North and Mid Yorkshire as well as the fringes of adjacent counties. The study excluded all burn patients that died prior to arrival, and minor injuries that were treated in local hospitals not requiring admission to a specialized unit.

Data collected from medical records included age, marital status, circumstances surrounding the cause of burn, social problems, previous psychiatric history and deliberate self harm, surface area, depth and site, number of surgical procedures, length of stay in the hospital and outcome.

Information regarding the anatomic regions involved in the burn was obtained from medical records. Maps with the most frequent anatomical regions involved by burns were drawn for each group. Using a numerical coding system of the body areas, the regions taken into account had to be injured in more than a third of the patients for each study group.

Data obtained was analyzed using Statistical Package for the Social Sciences (SPSS).

3. Results

During the 11 year period, 1745 patients were admitted with acute burns to the Regional Burn Centre. Of these, 41 patients (2.4%) were victims assaulted by burning and 86 patients (4.9%) were admitted with self inflicted injuries.

Patients in the assault group were relatively young with a mean age of 29 years (range 3-66). Twelve of the victims (29%) were in the age group 3-16 years and 75% (31 patients) were under the age of 40 years (Fig. 1). The mean age for the patients in the self immolation group was 37 years (range 17-67), a third of them (32.6%) being under the age of 30 years. Fifty percent of the suicidal patients were in the age group 30-50 years (Fig. 2).

Twenty-nine patients (71%) in the assault group were male with a gender ratio 2.4:1. Fifty-two of the self immolators (60.5%) were male, with a gender ratio of 1.5:1.

Of the 41 patients assaulted by burning, there was one Asian patient and another of Afro-Caribbean origin. In the self inflicted group, there was a preponderance of Caucasians (75 patients-87%), 11 patients (13%) being of Asian origin.

The marital status of both groups is shown in Table 1. In the assault group children represented 29.3% whereas the majority of self inflicted burns were single adults (40.7%).

Previous studies have shown that alcohol and substance abuse as well as a previous psychiatric history are predisposing factors for deliberate self harm. A history of alcohol and substance abuse, and/or imprisonment was recorded in around a quarter of the patients in the self immolation group (27.9%) as well as in the assault group (22%). In the assault group, substance abuse was noted in five patients

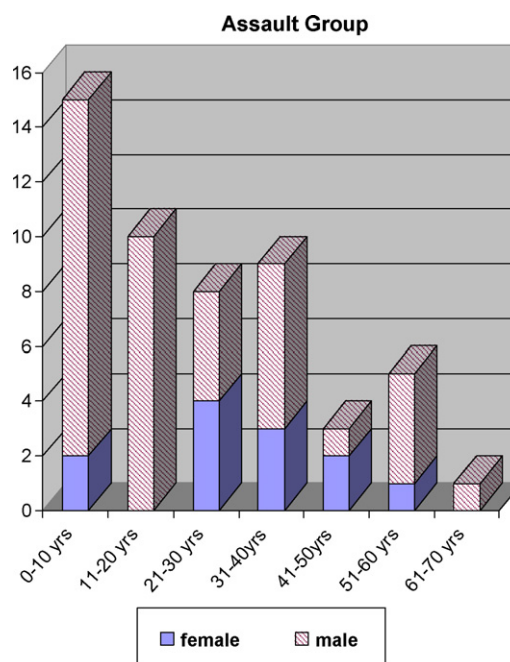


Fig. 1 – Age and gender distribution of the patients from assault group.

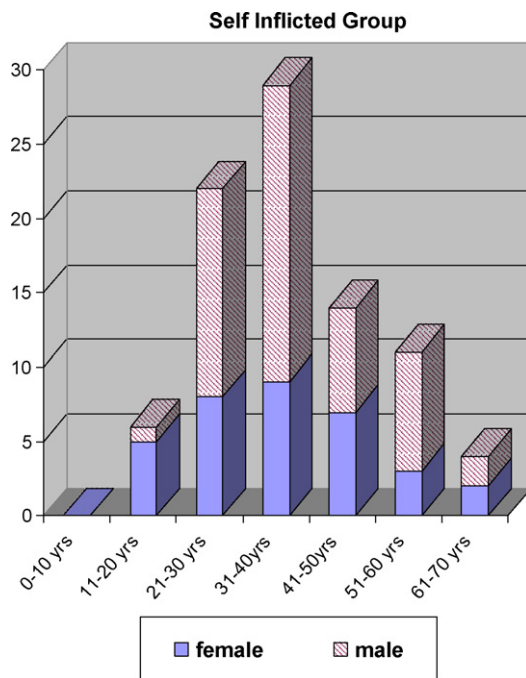


Fig. 2 – Age and gender distribution of the patients from self inflicted group.

and alcohol consumption in only four patients. In the self inflicted group only five patients had a positive history of substance abuse.

Reviewing the psychiatric morbidity among the self inflicted group revealed that the incidence of previously diagnosed psychopathological disorders was 62.8% (Table 2) and 36 patients had tried deliberate self harm at least once prior to the burn (range one to seven times). Surprisingly,

Table 1 – Marital status for the two groups of burn injuries

Marital status	Self Inflicted injuries		Assault by burning	
Single	35 pts	40.7%	10 pts	24.4%
Married	21 pts	24.4%	5 pts	12.2%
Divorced	9 pts	10.5%	8 pts	19.5%
Children (<18 years)	0	0%	12 pts	29.3%
Unknown	15 pts	17.4%	6 pts	14.6%

12.2% (five patients) of the assaulted victims had also a positive psychiatric history: four patients were depressed and one patient was treated for schizophrenia.

Flame was the principal mechanism of injury (>80%) followed by scalding, and the occasional use of chemicals (Table 3). Petrol was the most frequent agent used followed by paraffin. Fifteen patients (17.4%) used matches to set their clothes on fire. House fire was used as method of aggression (five patients) as well as self infliction (nine patients).

In the assault group, the surface area involved by burns ranged between 1 and 93% TBSA, with a mean of $17.2\% \pm 2.9\%$ TBSA. Partial thickness (mean = 8.4% TBSA) and full thickness burns (mean = 8.7% TBSA) were equally distributed. The extent of the burn injuries in the self inflicted group ranged from 1 to 95% total body surface area (mean $27.8\% \pm 2.9\%$), the full thickness component covering significantly larger areas (mean 22.5% TBSA) than the partial thickness (8.39% TBSA) ($p < 0.002$).

In the assault group, the most frequent areas involved were: face, neck, pre-sternal area, right forearm, hands, thighs and posterior aspect of the knee and both lower legs (Fig. 3).

The pattern of distribution in men involved more the forehead and face, buttocks, pectoral area and right lower leg, while in women, infra-umbilical area, left scapular area, lumbar area predominated (Fig. 3).

Table 2 – Psychiatric history in the two study groups

Psychiatric history	Self inflicted injuries		Assault by burning	
No psychiatric history	32 pts	37.2%	37 pts	87.8%
Depression	29 pts	33.7%	4 pts	9.8%
Schizophrenia	6 pts	7%	1 pts	2.4%
Affective disorders	3	3.5%	0 pts	0%
Deliberate self harm syndrome	5 pts	6%	0 pts	0%
Unspecified psychiatric history	10 pts	11.7%	0 pts	0%

Table 3 – Mechanism of burns in the self inflicted and assault groups

Cause of burn injury	Self inflicted		Assault	
	No. of pts	Incidence (%)	No. of pts	Incidence (%)
Petrol	16	18.6	10	24.4
Flammable fluids	24	27.9	9	22
Matches	16	18.6	0	0
Paraffin	6	7	0	0
Hot oil/fluid	5	5.8	7	17.1
Set house on fire	9	10.5	5	12.2
Chemical	1	1.2	1	2.4
Electrical	3	3.5	0	0
Others	6	7	9	22

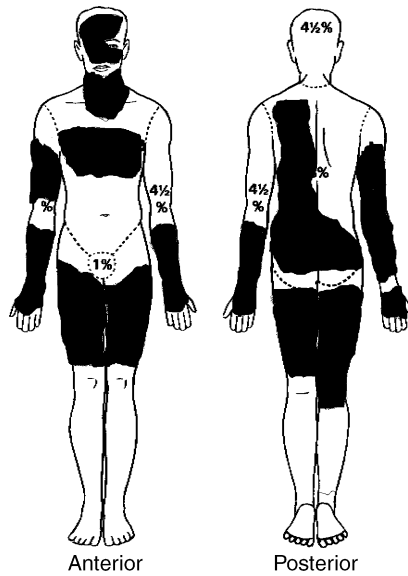


Fig. 3 – Distribution pattern for burns in assault group (a, general pattern; b, male pattern; c, female pattern).

In the self inflicted group, the burns were frequently present on the face, neck, anterior trunk, lower back, arms, elbows, forearms and wrists, anterior aspect of the thighs (Fig. 4).

A higher frequency was observed for thermal injuries on the lower back and buttocks on females, where the upper back was more affected in men.

Thirty-six patients (42%) from the self immolation groups as well as 11 of the assaulted patients (27%) sustained inhalation injuries and required intubation and intensive care unit (ICU) stay. Escharotomy was performed in 19 patients (22.1%) with self inflicted burns and only in three patients in the assault group. Fifty-eight out of 86 patients (67.4%)

underwent 92 procedures of debridement and skin grafting. In the assault group, 23 patients (56.1%) had 39 interventions (debridement and skin grafting). In comparison with the assault group, the self immolation patients required longer admission in the hospital, the mean duration of stay being 21.5 days versus 19 days. Twenty-five patients died in the self inflicted series which yielded a mortality rate of 29.1%. In the assaulted group, only two patients died, the crude mortality being 4.9%.

In the self inflicted group 32 patients were discharged home, 3 patients went back to prison, while 16 patients (18.6%) were transferred to a psychiatric hospital. All the patients from the assault series were discharged to their homes. After discharge, all patients from self inflicted group were reviewed and followed up by psychologist and psychiatric team.

4. Discussion

In the last two decades, in Western Europe, the incidence of suicidal attempt by burning varied from 1.98% (Spain) to high as 14% of total burn admissions (Holland) [7]. The United Kingdom is a multicultural society and the reported incidence of self inflicted burn injury varied from 0.7% in Essex (1979–1991) to 8.54% in Yorkshire (1983–1993) [8,9]. Yorkshire is one of the largest counties and Asian community is well represented (2.9%, Census 2001). A previous study of self inflicted burns presenting to Pinderfields Burn Centre between 1983 and 1993 showed that 70% of the self immolators were females of Asian origin [9] compared to 11% in the present study.

Retrospective studies performed in several countries such as China, Hong Kong, South Africa and the USA showed that the incidence of assault by burning varied from 1.9 to 20.9% of total acute burns admissions [1]. It might be likely that the true incidence of assault by burning was higher than 2.4% but these patients did not require the attention of a Burn Centre for

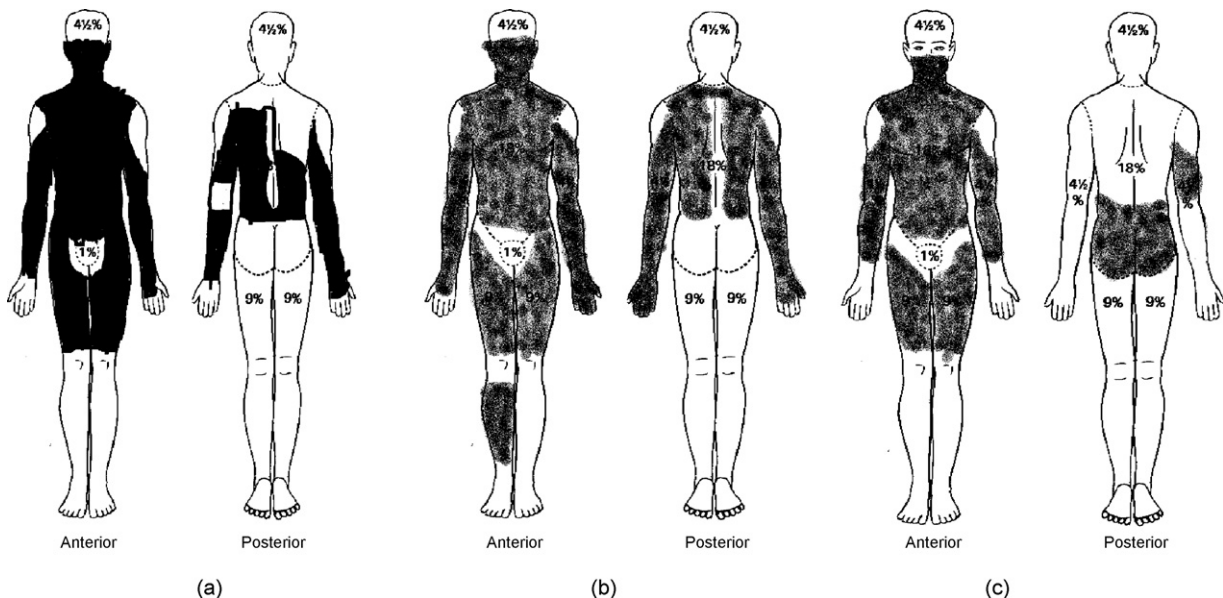


Fig. 4 – Distribution pattern for burns in self inflicted group (a, general pattern; b, male pattern; c, female pattern).

management or follow up. Other factors that influence the incidence of assault by burning are the selected nature of our services, local cultural factors and a victim's unwillingness to allege assault.

In common with large series, the mean age of the self immolators was 37 years, whereas the victims of the assault had a mean age of 29 years: lower than reported previously (mean age = 33 years) [10-12]. A reason for this it might be that in our study group eight patients were under the age of 16 years.

There was a preponderance of male patients in both study groups. In the assault group, male preponderance (70.7%) correlates well with previous studies (Fig. 1) [1,10,11]. In the self inflicted group, retrospective studies did not conclude constant gender preponderance, due to possible cultural differences, traditions and the country where the studies originated [5,13,14].

In the self inflicted group there was a relatively high proportion of patients that were not involved in a stable relationship when compared with the general population (40.7% single, 10.5% divorced) [13,14]. Living alone, with serious health or emotional problems make people more susceptible to suicidal thoughts and depression [1]. Among adult victims of assault by burning 33.3% of the females were unmarried.

Alcohol and substance abuse has been identified as associated factors for intentional injuries by burning [15]. Almost a quarter of the victims of assault had a history of alcohol and/or substance abuse at the time of injury. Due to their dependencies, this group of patients are prone to be instigators or perpetrators rather than the victim of the assault.

A significant psychiatric history was present in the group of self immolators: schizophrenia, major depression, affective disorders or deliberate self harm syndrome, the incidences varying from 43.3% [14] up to 90.9% [13]. Greenbaum et al. stated that self inflicted burn injuries are generally under-reported in the United Kingdom and described the profile of the patient as a young man generally with a psychiatric disorder. Our study showed that 62.8% of the patients had a psychiatric history, 42% of the self inflicted group having previous attempts of self harm.

In the assault group, 12.2% of the patients were diagnosed with psychiatric disorders. McArthur and Moore (1975) documented that neurological disease and psychiatric disorders are predisposing factors for burns although not particularly for the assault [12,16].

As past studies have demonstrated, flame was the main mechanism of injury in our series, petrol and flammable fluids being the most frequent agents. In the self inflicted group, petrol, flammable fluids and paraffin accounted for 46.5% of the total injuries, ignition of the clothes representing 17.4%. Duminy and Hudson (1993) showed that assault by hot fluids is underestimated, scalding being recorded in 17% of the cases in our series.

The extent and depth of the burn was a direct influence on mortality and morbidity measures such as duration of hospitalization.

Previous studies reported that the extent of burn in assaulted patients varies between 13.7% [11] and 24.8% [10].

Duminy and Hudson [11] studied only assaults with hot water and this could be an explanation of the smaller burns sustained in their series. In our assault group, the extent of injuries had a mean of 17.2% TBSA. Partial thickness and full thickness burns had an equal prevalence, whereas Duminy reported a preponderance of superficial burns (43/84 patients). Almost 80% of the patients in our study group had burns <30% TBSA.

In Western Europe, the reported extent of self inflicted burn injuries varied from 14% TBSA to 44.4% TBSA [7]. In England, the severity of burns varied significantly between different areas, the lowest figures being 22% TBSA in Essex [8]. Our study shows a significant reduction of the surface area involved by burns (27.8%) in comparison with an earlier study performed by Sheth et al. in the same Burn Centre (44.4%) [9]. Few studies considered the distribution of partial and full thickness burns throughout the series. It is recognised that in the self inflicted group, the burns tend to be deeper and more extensive, full thickness burns being predominant. Tsati reported in his study that 80% of the mean TBSA (41.6%) was a full thickness burn.

The assailant tends to injure exposed areas that are not easily protected in order to cause important functional disability or disfigurement. Burns distribution can be accounted for by a combination of the defensive position of the victims and the intention of the assailant (Fig. 1), the most frequent areas involved being: face, neck, sternal area, right forearm and anterior thighs. These patterns differ slightly between the genders, in the male patients burns over the back and buttocks being more common than female group.

On the other hand, in the self inflicted group, the distribution of burns followed the pattern of self ignition, the most frequent area involved being anterior trunk, upper extremities, face and anterior thighs. Interestingly, in male patients both hands and fingers are more frequently burned than in the females.

In the self inflicted group, there were more extensive burns of the anterior and posterior trunk and of the upper extremities than in the assault group, where the lesions were patchy and did not involve the upper abdomen, probably due to defensive positioning of the victim.

In both groups, more than half of the patients required one or more surgical procedures which consisted in debridement and skin grafting, but without any significant differences (67.4% in the self inflicted group versus 56.1% in the assault group). In comparison with other studies, the incidence of surgical procedures in the victims of the assault was quite high, albeit Dorn et al. reported 188 surgical procedures performed on 85 patients [10].

The shorter stay in the hospital could reflect current practice of an early surgical management of burns as well as the high incidence of superficial burns. In our study, there was no significant difference between the self inflicted group (21.5 days) and the assault group (19 days). Previous studies of assault by burning reported a hospital stay period ranging from 17 days [11] up to 65 days [12]. The duration of hospitalization in the self inflicted group is shorter than those reported in previous studies [14].

Mortality is a reflection of different factors that influence the evolution of burns. Self inflicted patients have a higher

mortality than patients with the same injury acquired in non-intentional circumstances [1]. A possible explanation may be the presence of psychiatric disorders which usually are associated with non-compliance with treatment as well as the other phenomena of self neglected. Our study showed a mortality of 29.1% which is similar to Essex County [8]. In Western Europe, the lowest mortality was recorded in a Helsinki study (17.4%) whereas the highest was reported as 48% in Middlesex, UK [18].

Burns will result in life long problems affecting the individual long after discharge from a Burn Centre. In the self inflicted group, 16 patients required transfer to a psychiatric wards for further treatment or because they were admitted prior to the burn injuries. After discharge, all patients from self inflicted group were followed up closely by the psychiatric team and psychologist. In the assault group, patients were discharged back to the community.

5. Conclusion

Although intentional burns are uncommon in our society accounting for only 4.9% of self inflicted group and 2.9% of assaults, they still represent an important medical and social issue worldwide.

From our data, several conclusions have been drawn. Adequate preventative measures need to be instituted and further education of the families of the patients with known psychiatric disorders are required in order to reduce the incidence of self inflicted injuries. A high incidence of previous attempts to self harm can be an indication of possible self infliction by burning. Increased awareness is required especially regarding children and the elderly where non-accidental injuries are more frequent.

Flame is the main mechanism of injuries in both groups which explains the high incidence of inhalation injuries, as well as the mixed pattern of burning and predominance of deeper burns in self inflicted group. There was a difference of distribution pattern between the two groups as well between males and females, the most frequent areas involving face, neck and upper part of the anterior trunk, upper extremities and anterior thighs.

The management of the burns caused by attempted suicide or by assault requires a multidisciplinary approach, significant

medical, financial, psychological occupational and social support being required.

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