

Review

Intentional burn injury: an evidence-based, clinical and forensic review

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Abstract

Burn injury can be inflicted intentionally either by one person to another whenever one has the ability to physically control the other, or it can be self-inflicted. There is scant evidential basis for much that is written about and practiced in the evaluation and care of patients that have sustained intentional burn injuries. Yet this is an area in which medical personnel must necessarily be trained in both the therapeutic and forensic aspects of a complex problem. Failure to appreciate the complexity of medical and forensic interactions may have far reaching effects. A missed diagnosis can result in inappropriate medical care, on-going abuse and future fatality. Inept management can result on the one hand, in blame levelled inappropriately placing incomparable strain on family units and innocent parties, and on the other, allow abusers to continue unchecked.

This is the first review on the subject in which lawyers and doctors collaborate to produce a holistic approach to this subject. In it we describe the legal considerations that medical staff must appreciate when approaching patients who may have suffered intentional burns. We analyse the various scenarios in which intentional burning can be found and challenge the clinical dogma with much of the management of paediatric inflicted burns has become imbued. We suggest a rational and balanced approach to all intentional burn injuries—especially when children are involved. In the light of current case law in which dogmatic medical evidence has been implicated in wrongful convictions for child abuse in the UK, it is imperative that medical professionals gather evidence carefully and completely and apply it with logic and impartiality. This paper will aid clinicians who may not be experienced in dealing with burn injuries, but find themselves in the position of seeing a burn acutely, to avoid common mistakes.

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1. Introduction

Intentional burn injury occurs in several settings. The words “deliberate”, “inflicted” and “non-accidental” appear as synonyms in the published literature to describe mechanisms of burning other than the accidental. Perhaps the first scenario that comes to mind is inflicted burns by adults on children, but clearly, burns can be inflicted by anyone on another, provided the person inflicting the burn is able to control their victim. The elderly, the infirm and the mentally sub-normal, all of whom may be vulnerable through dependency on others can be victims of intentional burning. In addition there is a group who are burned for political and criminal purposes during torture and interrogation and finally, there are those who burn themselves as part of an attempt at suicide or deliberate self-harm. Table 1 categorises those who experience intentional burning and common mechanisms of injury.

We have seen examples of intentional burning in each group in clinical practice. Our reading has led us to conclude that there is much published dogma that is without an evidential basis but which is accepted as “fact”, particularly with respect to children. This article reviews the evidence for and against the commonly cited perceived wisdom on the mechanism, symptoms, signs and epidemiology of intentional burns. It challenges some dogma on the subject and explores some of the forensic aspects of this problem.

2. General forensic considerations in UK law

When examining a patient with a burn, or for that matter, any injury it should be remembered that litigation, either criminal or civil, might follow. Most doctors are aware of the criminal offences of assault and causing grievous bodily harm but there are also offences concerning neglect or

Table 1
Victims and mechanisms of intentional burns

Victim	Perpetrator
Who gets burned	
Children	Parent, guardian, partner of parent, sibling
Elderly	Partner, carer (relative or professional)
Infirm	Partner, carer (relative or professional)
Self	Self (accomplice)
Captives	Government/civil authorities, kidnappers
Mechanism of burn	
Scalds	
Contact (hot and cold)	
Chemical	
Electrical	
Friction	

gross negligence that could present as “accidental”. Similarly, most doctors are aware that civil litigation may follow where an injury is alleged to be the result of negligence, but not that it may also arise in the field of family law with suggestions of neglect of children, and in immigration law (when recent injuries might be used to support a claim of historic torture). Doctors should therefore be particularly careful to make clear and comprehensive notes. These should include notes of historic injuries because these may often be of significance, especially when there are allegations of neglect, continuing abuse or where someone is claiming to have been the victim of torture. In all cases where litigation is likely, photographs of the injuries should be taken as soon as is practicable. This is particularly important where criminal offences may be charged. The basic rule for admissibility of evidence is that it must be relevant and probative; it is always better to gather too much rather than too little evidence and then to allow lawyers to determine what is admissible or not.

When noting what a patient says a doctor must be careful not to paraphrase or interpret to too great an extent. It is not uncommon for the doctor’s notes to be used against the patient by a lawyer to demonstrate a “previous inconsistent statement” where the patient’s testimony at trial differs from the account recorded by the doctor [1]. This may well occur without the doctor who made the notes ever being informed or called as a witness.

It should be remembered that if a doctor’s notes are sufficiently thorough, legible and accurate, that doctor is far less likely to be required to attend court to give evidence. Further when expressing an opinion as to how the injury was caused, it is wise to state all possible causes of the injury (albeit stating that some causes are less consistent than others) as this will also often mean that the doctor is not required to give evidence in court.

When viewing patients with burn injuries it is prudent to have in mind that a number of different criminal offences may have been committed. Different legal jurisdictions have different descriptions for offences against the person but the basic elements will be similar. For the United Kingdom the

most likely offences are set out below as they are characterised in the relevant statutes.

2.1. Actual bodily harm

This is an assault (unlawful application of force) causing actual bodily harm—namely some harm that is more than merely transient or trifling [2].

2.2. Grievous bodily harm

This is an unlawful and malicious (in other words, deliberate or reckless) infliction of really serious harm [2]. There is also the more serious version of this offence committed where the offender intended to cause really serious harm at the time he inflicted the injury [2]. Evidence of intent may be provided by the physical manifestation of the injury—so for example, if a child would have had to have been held in scalding water for a long period of time for the injuries to be caused, it is likely that the injuries were deliberate and that the person inflicting those injuries intended to cause that child really serious harm.

In such circumstances, it is also helpful to have an accurate prognosis so that a jury can decide whether any burn constitutes ‘really serious harm’. For instance a burn that will heal within a week is likely to be considered as only amounting to actual bodily harm whereas a large area of permanent scarring would almost certainly constitute really serious harm.

2.3. Manslaughter (unlawful act)

This occurs when there is an unlawful act (for example an assault) that all reasonable people would realise would subject the victim to the risk of some physical harm (not necessarily serious) but that that results in death.

2.4. Manslaughter (gross negligence)

This occurs when the offender owed the deceased a duty of care (for example: a parent, carer or employer) and there was a breach of that duty of care causing the victim’s death (child, charge or employee) wherein that breach of the duty amounted to gross negligence.

2.5. Murder

A person commits murder when he kills a human being with intent to kill or cause grievous bodily harm.

In cases of homicide in the United Kingdom the offence may still be committed even where the victim does not die immediately or soon after the unlawful act or omission. The common law rule that death must follow within a “year and a day” has been abolished for all offences committed since June 16, 1996.

2.6. Ill-treatment, neglect, cruelty

There is legislation protecting the young [3] and the mentally ill [4] from ill-treatment and neglect. There are a large number of specific offences and it is unhelpful and unnecessary to set out here the elements of them all. However, most offences involve a person with a specified duty of care wilfully ill-treating or neglecting either a patient receiving treatment for a mental disorder (for instance as an in- or out-patient in a hospital or care home) or a child under the age of 16 years.

An offence is very likely to have been committed if a patient or child has received a burn injury and their carer has failed to take them to hospital as soon as was practicable.

In these cases the alleged conduct may have occurred over a substantial period of time. The injury with which the patient presents may not be particularly serious and may be accidental. If however that person is under 16 or mentally ill, a doctor must consider whether there is evidence of ill-treatment or neglect (for instance if a patient regularly burns themselves on a stove or radiator because of inadequate supervision). This is the type of case where a thorough history and noting of other injuries may be of particular significance. It is helpful to provide an estimate of how old an injury is, whether it may have become infected and not treated (this of itself could constitute neglect) and any other factor(s) tending to show a pattern of abuse or neglect. The apparent age of an injury may have particular significance as this may be matched to periods of time that people (for instance a particular babysitter or carer) had access to the victim.

Most hospitals and medical practices will have established protocols for alerting police or child protection agencies in suspicious cases. The doctor's role is not ideally one of forensic investigator, although this role may fall, of necessity, to the first clinician to see a patient and so it behoves medical staff to train and prepare appropriately. Ideally police and specialist physicians and scientists will undertake a definitive forensic examination, but the initial examination and information that a doctor can provide is invariably of great value, not only in providing evidence against the guilty but also in exculpating the innocent—it may often provide the only evidence.

3. Intentional burning in children

3.1. Epidemiology

Child abuse was first described in medical literature 40 years ago [5]. In England and Wales it has been estimated that four children die each week as a consequence of non-accidental injury (NAI) [6]. In these two regions of the UK alone, some 40,000 children are deemed to be sufficiently in danger of abuse to merit inclusion on the child

protection register [6]. In the USA, the estimated death rate from NAI to children is 1000 annually [7].

Estimates of the incidence of burns inflicted upon children vary. In part, this seems to result both from differing remits of different studies and from differing definitions of non-accidental, or inflicted burns—with blurred boundaries on an injury continuum spanning accidentally, neglectfully and deliberately inflicted burns.

3.2. Incidence

Comparison of studies published from dedicated paediatric burns units compared with those from emergency or paediatric departments show widely varying estimations of the incidence of inflicted burns on children. It is hard to attribute these differences to the situation of the units (urban or rural), or the chronology of different studies, or the socio-economic makeup of the communities served. Estimates start at <1% in Devon and Cornwall [8], through to 4.2% of burn admissions in a deprived area of Chicago [9] or 4.3% in rural New Zealand [10]. A study from Sydney has distinguished injuries that caused concern (6%) from those that the authors felt were due to abuse or neglect (8%) [11], but these might have been combined or placed in a “cause for concern group” using criteria from other published studies. The highest estimates are 10.5 and 16%, both from urban areas [12,13]. Our investigation of figures for inflicted burns referred through the Regional Paediatric Burn Unit in Manchester and from data from the Greater Manchester Police (GMP) on investigations and prosecutions for child abuse involving inflicted burns support Hobson's data [8] and those of Kumar reporting on the same region's admissions for inflicted burns 20 years ago [14]. Over a 3-year period, GMP investigated 14 cases of children who had sustained burns, which amounted 1% of all physical abuse investigations in that period. From these 14 investigations, prosecutions followed in 12 (one proving accidental and the other having insufficient evidence to proceed) [15]. A breakdown of these data is shown in Table 2.

3.3. Children

The age of children sustaining intentional burns provides more consensus, with most studies placing the mean age of children suffering inflicted burns between 2 and 4 years [9–13,16].

Boys are between two and three times more likely to be affected than girls [9,10,13,17]. There is also a common association between inflicted burns and families with two or more children: most often the child suffering abuse is the youngest [18]. Children suffering inflicted burns often have symptoms and signs of previous and concurrent physical and emotional abuse [13,18–22]. Ethnic composition of the community is reflected in the ethnic composition of children affected [13,18]—no particular ethnic predisposition exists.

Table 2
GMP inflicted burns on children data for 1998–2000 [15]

Type of burn	Referral source	First medical examination	Second medical opinion	Disposal
Liquid scald (4)	Parent/hospital (7)	Hospital (13)	Seven cases	12 prosecuted
Cigarette contact (7)	Parent/GP (1)	GP (1)		1 proved accidental
Hairdryer (1)	Playgroup/social services (1)			2 non prosecutions
Iron (1)	School/social services (3)			
Unidentified (1)	Anonymous call/social services (1)			
	Direct to police (1)			

14 cases of inflicted burns on children referred for investigation to GMP family support units 1998–2000.

3.4. Adults

All studies show associations between inflicted burns and both low family income and single parenthood (which is not to say that the wealthy don't abuse children by burning them, only that this form of child abuse is more commonly associated with low income families). Andronicus et al. [11] found children with inflicted burns were 9.6 times more likely to come from single parent families, while other studies show that over 70% came from single parent families [13,14,16,19,23], and that up to 96% came from families with low income [19,21,23]. This may well be a reflection of the strong, common association between low educational attainment on the part of parent(s) and inflicted burns [18,19]. In up to 70% of cases inflicted burns the assault is perpetrated by young women and 50% of these women are the children's mothers [18]—possibly reflecting only the predominant role of females in early age child rearing, toilet training and discipline, which represent emotional flashpoints. A strong association has been noted between a past history of abuse (spousal or parental) suffered previously by an adult who then inflicts a burn on a child [13,19].

3.5. Mode and severity of injury

There is no agreement on likely methods of burning. Some studies showed a majority of inflicted burns due to hot water scalding [9,12], whereas others found hot objects, fires or cigarettes were implicated more often than scalding [11,14,17,18]. The Manchester data agree with the latter finding.

Children with inflicted burns have higher associated morbidity and mortality than accidental burns, spending longer in hospital, having more septic complications, needing more operations and dying more frequently than children with accidental burns [10,12,23].

3.6. Clinical evaluation

3.6.1. General points

Health care professionals have legal duties to investigate and report suspected abuse of children [24,25]. In the USA, all States have mandatory reporting laws. There, it is only the suspicion of abuse that is necessary for reporting and doctors

must report possible abuse even when they hear of it through a third party [7]. Both “carrot” and “stick” function in the US system: reporting is encouraged by States' provision of immunity from liability for “good faith” reporting of child abuse by “mandatory reporters”, whereas failure to report leaves doctors liable to both criminal and civil action [7].

In both the UK and USA provision is made within the law for children to be taken into care for their own safety when indicated and details of this intervention should be available readily in relevant hospital departments (A&E; Burn and Paediatric Units).

Abuse is symptomatic of dysfunction, and its origins in the abuser may be rooted in poverty, desperation, substance dependency and their own previous abuse. A balanced approach to the perpetrators of inflicted burns by health care professionals (despite understandable revulsion at the perpetrator's behaviour) is vital: weighing on one side the realization that they are also damaged and in need of help, with the fact that they have committed a crime on the other.

Whilst initial investigation and medical management falls to the first professional to meet the child, subsequent management must be within a multidisciplinary team setting [26].

The initial priority for an examining doctor is the identification of life-threatening conditions and their treatment. Thereafter, identification and prompt, complete recording of symptoms and signs of abuse or neglect (including photographs) become paramount.

It should be borne in mind that absent siblings may be involved or at risk also. It is vital to remain objective and approachable at all times—things may not be as they appear. In the same vein, questions from parents and guardians should be answered honestly, whilst not inadvertently prompting them with insights that may encourage them to alter their histories and fabricate convincing alternatives.

3.6.2. History

It is vital to try and gain a history from the child alone at some stage in the assessment (whilst chaperoned by a paediatric nurse), and during this exchange, to tailor questions to the child's developmental level. Ideally, this assessment of the child should be conducted by the most experienced member of the medical team in attendance. Questions should not be limited to the burn injury because many forms of abuse coexist.

3.6.3. Examination

3.6.3.1. Pattern of injury.

There is broad agreement in the literature on several patterns of scald injury that *should raise the possibility of the diagnosis of inflicted burn injury* in the clinician's mind [9,12,13,17,27,28].

1. Scalds with the absence of splash marks are said to imply that a child was held still, however, we feel that this is a simplified picture: children immersed in hot water may struggle and fight to get away from the scalding liquid (and so will have splash marks), yet on the other hand, some young children who jump into a bath with hot water, panic, freeze and stand still in water, giving themselves a symmetrical, unsplashed burn distribution. Fig. 1, however, shows splash marks on a child forcibly immersed in hot water and controlled there by an adult.
2. Uniformity of burn depth is said to imply a child has been held still.
3. Bilateral burn symmetry (so-called “glove” or “stocking” distributions) implies a child has been forcibly immersed. The photographs in Fig. 2 show the legs of



Fig. 1. Hot water splash marks.



Fig. 2. The legs of a little boy who was forcibly immersed in a bath of hot water. These photos were taken 3 days after the burn and erythema is still just visible above the obviously burned skin on the left leg indicating that the original injuries would have appeared symmetrical, but during the 3 days since the injury the upper, superficial burn on the left leg has recovered and the corresponding area on the right leg has deepened. Beware of pictures and be aware that appearances change rapidly for various reasons after a burn injury and opinions given should take this into account.

a little boy who was forcibly immersed in a bath of hot water. cursory comparison of left and right legs suggests the legs were immersed to different levels and this is not a classical symmetrical “glove and stocking” scald distribution. However, these photos were taken 3 days after the burn. Erythema is still just visible above the obviously burned skin on the left leg indicating that the original injuries would have appeared symmetrical, meanwhile the upper, superficial burn on the right leg has deepened, but the corresponding area on the left has recovered. Time, dressings and physiology affect different parts of the same burn and alter the appearance of the burn—this must be borne in mind when offering opinions (especially on pictures of an injury) and highlights how crucial it is to photograph burns immediately, before pathological and physiological processes alter their appearance. In this case the abuser's defence barrister argued that the lack of symmetrical “stocking distribution” scalding “as described in the literature” meant this injury must be accidental—this argument was only unsuccessful because of the experience and expertise of the clinician who noted the salient points described above and integrated them all to rebut a defence rooted in medical dogma.

4. Skin sparing: the presence of spared areas within areas of burn and sharp demarcations between burned and unburned skin (such as in joint flexion surfaces) implies that the child, whilst held immersed in a hot fluid, either flexed and withdrew or was forcibly flexed until it could flex no further, so sparing from the heat areas of skin in contact with each other. Also, sparing of the soles of the feet or the palms of the hand are signs said to imply that the spared surface was in contact with the fluid receptacle (such as a bath or sink) and so was relatively spared from the burn as heat was conducted away. This last sign could equally result from a child standing rooted to the spot with pain and fear, or with feet or hands pushed forcibly down by someone stronger.

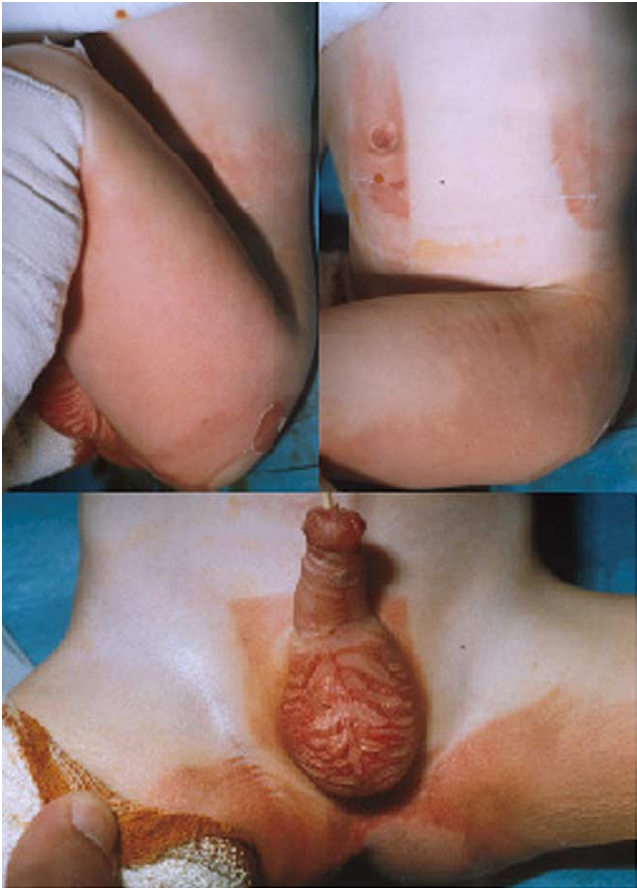


Fig. 3. Progressive force on this little boy's back and shoulders from above whilst he was stood into a hot water bath, brought first his legs, then his peno-scrotal area and finally a strip of abdominal skin into contact with hot bath water, whilst progressively sparing surfaces of skin compressed against each other in flexural creases.

We think skin sparing is a robust clinical sign *in context*. For example, the photographs in Fig. 3 demonstrate how progressively pushing on this little boy's back and shoulders from above, as he was forced into a hot water bath, brought first his legs, then his peno-scrotal area and finally a strip of abdominal skin into contact with hot bath water, whilst progressively sparing surfaces of skin compressed against each other in flexural creases. It is implausible to explain these injuries by any other mechanism.

5. Andronicus found that children with inflicted burns were between 2.4 and 4.8 times more likely to have burns to hands, arms or legs bilaterally than were children with accidental burns [11].
6. There is generally disagreement as to whether total burn surface area (TBSA) is more or less extensive in inflicted rather than accidental burns [9–11,13,28,29].

Burning with cigarettes leaves relatively superficial, circular or ovoid macular scars whereas inadvertent burns (small children blundering into a lowered adult hand holding a cigarette) are superficial and ill-defined. Depending on skin



Fig. 4. A deliberately inflicted, 4-day-old cigarette burn to the forehead.

type and pigmentation they may depigment centrally and have indistinct, hyperpigmented edges [30] after healing has occurred. The tip of a manufactured cigarette burns at about 400 °C, whereas self-rolled cigarettes are much less tightly packed and burn at a cooler temperature. In addition the burning tip of self-rolled cigarettes are less mechanically robust and easier to brush off skin. Overall they are less likely to give rise to significant injury accidentally. Fig. 4 shows a deliberately inflicted cigarette burn to the forehead of a 20-month-old boy 2–3 days after injury.

Heated metal objects (domestic irons, radiators and electric heating elements) transfer more heat which is less readily dissipated and cause deeper burns [30].

Electrical shocks may cause small punctate burns according to the size of the contact points. Depending on current and duration of application burns will vary from full thickness necrotic defects to very superficial wounds, forming erythematous papules acutely that fade to hypopigmented, circular macules [31]. The appearance of these injuries may be very difficult to interpret, particularly when some time has passed since injury.

Our concerns have more to do with how clinicians apply these signs in the diagnosis of inflicted burns, than with the validity of any one of them in context. For each sign, an alternative explanation for burn injury mechanism is possible. Not just in the mind of a desperate defence lawyer, but in reasonable thought and experience. Each sign is valid, but its application in isolation, by clinicians inexperienced in what is a rare manifestation of child abuse is hazardous. It is the accumulation of a comprehensive picture, with a suggestive pattern of signs, which we feel constitutes safe practice in the diagnosis of inflicted burns in children.

3.6.3.2. Pattern of circumstances.

Lack of witnesses. It is common to find that the adult(s) responsible for the child, and possibly the burn, claim not to have seen the burning incident [9] and they may attribute the burn to a sibling [9,13,17]. Relatives other than the adult responsible for the burn commonly bring the child to hospital [9,13] and a delay between injury and seeking medical help is also a common association with inflicted burns [13,17].

Incompatible mechanism of injury. Often the burn is incompatible with history [13,17,28] and/or development and abilities of the child [13]. Other bruising or fractures on skeletal survey of varying age may be noted [9,13,28].

Previous abuse. Signs of other forms of abuse, such as a child being withdrawn and tolerating painful procedures as though pain is normal to them are often seen in association with inflicted burns [9,13].

3.6.4. Discussion

The commonest age for inflicted burns in children matches the period in early life when they are most demanding (2–4 years). Boys are more likely than girls to receive inflicted burns and the abuser is most likely to be a single, possibly immature parent of low socio-economic class with scant emotional and financial resources available to them. This combination of factors may result in a breakdown of self-control and the venting of frustrations [13].

It is fascinating to note that striking parallels exist between how adult humans abuse their young and how they abuse their pets. It has long been recognised amongst veterinarians that animals are more likely to be harmed when living within violent families, and significantly more so when living with families in which child abuse occurs [32]. Dogs and cats are most commonly abused when puppies and kittens (when they are least manageable and demand most attention) [33]. Male dogs are most likely to be abused (possibly because they are less manageable, or possibly because they appeal more to potentially violent owners than do female dogs) [33]. Cross breed dogs, which are cheaper to buy, are most commonly abused—suggesting a possible association with owners of low socio-economic class and non-accidental pet abuse too [33]. There are striking similarities also, between pets and children in the presentation of their injuries. An inconsistent history, a lack of history, the behaviour of the accompanying owner and the interactions between pet and owner, and the presence of previous injuries and stigmata of violence are all cited in the veterinary literature and are similar in description to those between adult and child [33,34]. Finally, the relative frequency of inflicted burns rather than other injuries amongst pets, seems to be remarkably similar to that in children [33].

Final to this discussion, comes the question of what is an acceptable accident and what is neglect? Clearly this is for case law and the legislature to decide, and as outlined earlier, the definition is clearer than many health care workers may realise, leaving them open to litigation if they do not act appropriately and alert the authorities. George and Ebrahim point out persuasively: “. . . infants need supervision in almost everything . . . if McDonalds can be sued for serving hot coffee to its adult customers, it is time that parents bear serious responsibility when their infants suffer scalds at home . . . accidents may not be totally avoidable, but burns from negligence can definitely be prevented. . . .” [35]. Parental educational and emotional development, as well as

cultural and religious beliefs may produce wide variation in what is thought to be abusive or negligent behaviour: for instance, an old Chinese custom of rubbing freshly boiled eggs on childrens’ bruises to bring out swelling has parallels with other cultures’ use of hot poultices, yet administering either can inflict severe burns [36]. The practice amongst orthodox Jews of leaving an urn in the kitchen boiling water for 24 h constantly over the sabbath period, rather than “performing work” (which is proscribed on the Sabbath for Jews) by boiling water when needed, has resulted in the characteristic “Shabbes burn”, mostly affecting young girls when they upset the urn accidentally [37]. Burns sustained from such an arrangement in a public place would surely result in litigation immediately, and paradoxically, by parents on behalf of their damaged children.

Burns are inflicted by adults on children not only as wilfully cruel acts of commission, but also through inadvertent, thoughtless acts of omission.

4. Intentional burns in the elderly and infirm

4.1. Epidemiology

In the UK, 10.8 million of the population is older than sixty [38] and the proportion of society over 60 is growing rapidly in both developed and developing nations. In the UK and USA this group accounts for 19% of the population currently, with a projected increase in the USA to 38% by 2050 [39]. By 2020, it is predicted that the elderly will outnumber children in the USA [40]. In India and China currently, the over 60s account for 8 and 10% of the population, respectively, with projections for 2050 of 23 and 30%, respectively [39]. Because better living conditions, medical technological advance and two generations without World War militate to prolong life, the proportion of the elderly in all societies is rising, along with the risk that they become dependent on relatively fewer family, financial and societal resources [41], and therefore, become more vulnerable—emotionally, physically and financially.

Elder abuse has been well documented generally in literature and folklore through the ages from the practice of Euthanasia in Ancient Greece, to the scape-goating of elderly, single women as witches in medieval Europe to King Lear’s maltreatment by his sons in law in Shakespeare’s play of the same name. It was first described in the medical literature in 1975 [42,43] but since then scant hard data on elder abuse have been produced.

Identifying elder abuse is harder than identifying child abuse: children cannot not legally live alone and must attend school, whereas the elderly often live alone, interacting predominantly, or exclusively, with the very family or carers who enact their abuse [39]. The abused elderly may collude with their abusers (unwittingly or purposefully) keeping their abuse secret for several reasons: shame and guilt—especially if children are responsible [44,45], depen-

dency on the abuser and fear of reprisal [45–47] and ignorance of their rights or the existence of mechanisms for help—especially if they are socially, geographically or ethnically isolated [48]. Some 50% of those abused exhibit some degree of memory impairment which adds to the complexity of the problem [47]. There is evidence that 80% of elder abuse comes to light only when someone other than the victim or a relative becomes involved [46]. Moreover, this process may be hindered by the ineptitude and lack of resources of the professionals concerned [49], their personal biases [50] and a lack of adequate provision in their training to recognise and deal appropriately with illegality, thus hindering effective and timely management of elder abuse as a criminal act [51].

4.2. Prevalence of inflicted burns in the elderly

Elder abuse can be divided into physical and non-physical and this review is concerned with a specific sub-group of physical abuse. We are aware of no data published on the prevalence of inflicted burns in the elderly. One retrospective study from a Burn Unit in the UK found that 18.6% of its geriatric admissions over a 45-month period occurred from a residential care setting and that these patients had 33% more TBSA affected and a 32% higher mortality rate from their burn injuries [52]. The majority of injuries involved scalds or radiator contact; all patients were incapacitated with severe dementia and “in the majority of patients a lack of supervision was in part responsible” [52].

In our own unit, a retrospective survey of some 550 cases of burn injury involving the elderly over a 5-year period reveal at most 5 where intentional burning was considered a possibility and only 1 of these (in which an elderly man was tortured by a relative to extract money) led to investigation and criminal prosecution.

From the USA there are some data on the prevalence of physical abuse to the elderly. Extrapolated data from a study in 1988 suggests 2.2% of elderly Americans (just under 700,000) were subject to physical injury, yet only 1 in 14 told somebody [53]. A Canadian study found a physical abuse prevalence of <1% [54]. Both these studies addressed the elderly resident in the community. There is qualitative evidence from one study that physical abuse is commoner in care institutions in so far as 36% of nurses surveyed in this study reported behaviour constituting physical abuse [55]. This suggests much more abuse in residential settings with more dependency of the elderly, but no assessment was made of how generally physical abuse was applied to residents [55]. Given that in the UK, 0.376 million live in an elderly residential care setting [38], there is an urgent need to investigate these data further.

4.3. Risk factors in the elderly

In the absence of data specific to burn injury, we are limited to discussing those data that exist for physical abuse of other sorts.

4.3.1. Relationships

The abused elderly are more likely to experience marital strife [56] and spousal abuse has been reported to account for half of all physical abuse in the elderly [53]. However, other data suggest that domestic elder abuse comes most often from adult children, then from spouses and then from other relatives [57,58].

Violence from carers is more likely if their elderly charges are demented and violent themselves, and especially so within a family setting, if the pre-dementia relationship between carer and elder was violent [59,60].

4.3.2. Carers

An abusive person is likely to make an abusive carer. In the elderly, abuse correlates best with emotional or financial dependence of the carer on the elder and often attests to the carer’s underlying problems including substance abuse, psychiatric disturbance, deviant behaviour and legal difficulties [61]. Alcohol use by a carer is the best predictor of elder abuse [61].

4.3.3. Cohabitants

There is no evident link between religion, ethnicity, socioeconomic group, educational attainment or substance abuse and a person’s likelihood of suffering abuse when older [53,62]. However, physical abuse has been associated with poverty, functional disability and (especially the onset of) cognitive impairment in the victims of abuse [63]. Physical violence is more common when living with others rather than alone [54]—if nothing else, living in an institution adds co-residents and their visitors to the victim’s carers and visitors as potential sources of violence. There seems to be no difference between the sexes in rates of physical abuse, once allowance is made for differences in longevity [53,62]. Evidence from one prospective study shows that after adjustment for demographic characteristics, chronic diseases, functional status, social networks, cognitive status, and depressive symptoms, elder abuse results in a clear increase in mortality for victims [64].

4.4. General points

Health care professionals have legal duties to investigate and report suspected elder abuse in the USA and most States have mandatory reporting laws covering suspected abuse [65]. Unlike with children, in dealing with elder mistreatment the duties of a doctor to report suspected abuse may produce ethical difficulties with respect to confidentiality, when competent elderly victims of abuse do not want it reported. American adults living in institutions have rights under the Nursing Home Reform Act 1987 (Public Law 100–203; Social Security Act, Title C) [65]. State laws require patients be admitted to nursing homes under a physician’s care and must then provide the physician immediate access to the patient [65].

As with children, abuse is symptomatic of dysfunction and its origins in the abuser may be rooted in poverty, desperation, substance dependency and their own previous abuse—possibly at the hands of the currently abused victim.

The initial priority of the examining doctor is to identify life-threatening conditions and treat them, and thereafter, to identify and promptly and completely record symptoms and signs of abuse or neglect (including photographs). It is important to have in mind that family dynamics are complex and suspected abuse in a domestic setting may involve other forms of violence affecting other family members. As with child abuse: always remain objective and approachable – things may not be as they seem – and answer questions honestly.

4.5. History

Try and gain a history from the patient alone at some stage in the assessment, tailoring the questions to the patient's cognitive level.

Ask direct questions.

4.5.1. Pattern of injury

Similar patterns of injury to those in children are to be sort in inflicted burning of the elderly and infirm. As stated previously, all should be interpreted in context and in dealing with the elderly and infirm, the medical examiner may have the advantage of a coherent patient who, in the absence of fear of reprisal, can explain what happened.

4.5.2. Pattern of circumstances

As with children, the person responsible for the care of the elder, and possibly the burn, may claim not to have seen the burning incident and they may attribute the burn to another.

The burn and history may be incompatible. Other signs of injury, abuse or neglect may be evident.

5. Self-inflicted burns

5.1. Epidemiology

Burns can be self-inflicted in an attempt at suicide (self-immolation) or as part of the deliberate self-harm syndrome (DSHS).

The DSHS consists of continual, sudden urges towards self-harm, usually associated with an intolerable situation that is beyond the control, and the ability to cope of the self-harmer. Sufferers have altered cognitive perception such that few alternatives are apparent to them and whilst pain is not perceived during mutilation, a sense of relief follows it, possibly mediated by endogenous endorphin release. Sufferers often have a depressed, though non-suicidal affect and common associations are substance abuse, female sex, eating disorders and a lack of social support [66,67]. Burning as part of DSHS usually involves a more easily controlled

method of burning (scalding, hot contact or a chemical) than self-immolation and the mean TBSA is much smaller (1.6% compared with 35.4%) [68–70].

The commonest parasuicidal mechanism for self-infliction of a burn is to douse oneself with an accelerant such as kerosene, rubbing alcohol or gasoline and then set fire to the propellant and clothing with a naked flame [71–75] although electricity, scalding and chemicals have been used too [76–79].

Self-immolation is a rare method of suicide in Western culture with studies reporting rates between <0.5 and 2% in adolescents and various rates up to 25% in adults [29,69,80–86], but it is estimated to account for between 9 and 32% of completed suicides in Iran, India and Zimbabwe [71,87,88] and between 41 and 46% of attempted suicides in Iranian and Brazilian women [89,90]. There is an argument that in the UK, it is an under-reported method of suicide because the Coroner's inquest system demands that the jury must be sure "beyond reasonable doubt" both that the deceased was responsible for their own death and intended to die as a result of their actions and, therefore, it may be that many suicides receive "open" rather than "suicide" verdicts [91]. However, there is strong anecdotal evidence for a general lack of appreciation of how fast and furiously commonly used propellants ignite and burn suggests that many 'successful' suicides may in fact have originally been attention-seeking parasuicides. This is particularly true when the victim has no other risk factors for suicide in their history.

Based on retrospective studies it seems that self-immolation suicides are between 1.5 and 1.7 times commoner than reported statistics and are predominantly a method chosen by men, the young and the severely mentally ill [72,73,77, 79,81,84,91–93]. Many other studies however, have found a preponderance of women in self-immolation suicide and an Asian or Latino association [29,70,74,88,94–97] whilst others report no sex difference at all [77,81, 98–100].

Fire carries connotations of punishment in all cultures and is commonly identified with purification in the Buddhist, Jewish, Christian and Islamic faiths [80,101]. There appears, amongst western adolescents who attempt suicide by self-immolation, to be associations with a past psychiatric history and a psychopathological family dynamic; an adherence to fundamentalist religious convictions (of whatever faith) and a poor response by others to their expressed suicidal ideation [80].

Recent history reveals a blurring between self-immolations that are religiously or politically motivated in so far as there is evidence that ethnic groups in which self-immolation is "accepted" religiously, have applied it to political protest. Arguable examples of this phenomenon include the spate of some 26 self-immolations occurred in the USA during the 1960s and 1970s, mostly by Buddhists and motivated by protest over the Vietnam War [102], whilst more recently the Branch Davidian Sect may have set themselves and their compound in Waco, Texas on fire in 1993 rather

than surrender their perceived freedom [103]. In India, 50 students self-immolated in protest at job quotas [104] and in the UK, a politically motivated self-immolation in 1979 triggered a “copy cat” epidemic in which none of the “copy cat” immolators had political motivations, but all had strong psychiatric past histories [105].

Culturally and religiously motivated self-immolation amongst women is well-characterised in the Indian sub-continent. “Sati” means virtuous or pure in Hindi and the Hindu custom of Sati describes the ritual suicide by self-immolation of a widow. Within the Northern Indian Rajput caste, Sati was considered the praiseworthy epitome of marital devotion [106]. Likewise, in ancient India, “Jauhar” was the practice of mass female suicide by immolation rather than risk capture and dishonour at the hands of Muslim invaders. The Jauhar of women in the Rajastani Fort at Chittor in 1303 AD, whilst their men died on the battlefield, is a celebrated example. Although not obligatory – indeed suicide is forbidden in the Shastras – many social pressures encouraged women to commit this ritual suicide: it was believed that death with their husband united them again in heaven, whereas life as a widow, usually without education or means, was that of a destitute and social outcast [107]. In Bengal, woman enjoyed equal inheritance rights with men and so the Sati system was often forced upon Bengali women [107]. Female self-immolations have been described sporadically in other cultures in modern times [89,108]. In Colonial India the practice of Sati was banned in 1829, and since independence in 1947 only 40 cases have been recorded—and the vast majority of these occurred in Rajput women [109].

5.2. History

Common findings in the histories of self-immolators are: previous psychiatric problems – often depression or borderline personality disorder – and a failed suicide attempt, low socioeconomic class and a recent life stress [71,72,81,92,100,110]. Kerosene and gasoline are the commonest used propellants [71,72]. Amongst DSHS “burners” common points in past medical histories include: bulimia and anorexia nervosa; poor family dynamics; inability to cope and feelings of helplessness; substance abuse and depression [67].

5.3. Examination

TBSA affected is usually large in self-immolators and burns are deep with a very high associated mortality [68–70, 81,88,89,100]. Many choose to immolate inside (home or automobile) and so inhalation injury is a relatively common co-morbid factor and cause of mortality [71,73,97].

5.4. Pattern of injury

Self-immolation with an accelerant produces extensive full thickness burns, often with an associated inhalation in-

jury. Substance intoxication may be part of the presentation and complicate management, as may inter-current psychiatric illness and poor compliance during treatment when depression worsens [84]. It is possible that with deliberate scalds, injuries may resemble forced immersion by a second party, rather than appear self-inflicted [111].

6. Intentional burning as part of assault, torture and interrogation

Torture and interrogation imply forced endurance of physical and/or psychological abuse whilst in captivity or custody. The American Association for the Advancement of Science has classified various ways burning can be used in torture and interrogation [112] which has been modified to use clinical terms and augmented in Table 3:

For convenience these injuries are subdivided according to whether they were committed as criminal acts under the auspices of some form of government or by individuals.

6.1. Government torture and interrogation

The Geneva Conventions and subsequent protocols forbid torture of combatants in internal or international conflicts (Convention I, Art. 3, Sec. 1A), of wounded combatants (Convention I, Art. 12) or of civilians in occupied territories (Convention IV, Art. 32), in international conflicts (Protocol I, Art. 75, Sec. 2Ai) and in internal conflicts (Protocol II, Art. 4, Sec. 2A). Yet in 1992, 92 countries (about 30% of the World’s Nations) used torture [30]. In the last 15 years, the use of burning or electrical shocks as part of state sponsored torture has been reported widely. For example it has been used in: Kashmir—both in children [113] and adults [113,114], Spain [115], Georgia [116] and Afghanistan [117]. In a 1997 report, Amnesty International alleged 50 countries had misused hand-held electro-shock weapons in the previous 7 years: “. . . *Electro-shock weapons have been deliberately, and often repeatedly, applied to sensitive parts of prisoners’ bodies, including their armpits, necks, faces, chests, abdomens, the inside parts of their legs, the*

Table 3
Burns during torture or interrogation

Burns	Electric shock
Chemical	To genitals
Cigarette	To body
Scalding with water	Unknown
Flame	Other
Other contact burn	
Necklacing (burning tyre or petrol)	
Immolation with petrol	
Tar and feather	
Unknown	
Other	

soles of their feet, inside their mouths and ears, on their genitals and inside their vagina, on their back and rectums . . .” [118]. In Afghanistan the Taliban regime used electric shocks to limbs and genitals during interrogations to achieve confessions and have passed sentence of death by “being set alight and his flaming body hurled from the tallest building in Kabul” as punishment for an Afghan red cross worker suspected of conversion to Christianity [117].

6.2. General points

Although reliable data suggest many regimes use torture routinely on both criminal and political detainees, deaths are comparatively rare and thus, it is likely that torturers are well-trained and occasional deaths are due to accident and misjudgement [30]. Judicious and early use of torture techniques within a relatively long period of detainment allows healing of many of the external marks of physical torture by the time detainees are released [30]. Lack of external marks after torture is a strong incentive for those regimes that are keen to hide their actions favouring electro-shock devices [118].

6.3. Sequelae of burn and electrical shock torture

Psychological symptoms are described most frequently after torture: impairment in memory, concentration and sleeping—both inability to sleep and nightmares during sleep; as well as anxiety, depression and mood swings [30].

Burning with cigarettes is common and this leaves relatively superficial, circular or ovoid macular scars. Depending on skin type and pigmentation these lesions may de-pigment centrally and have indistinct, hyperpigmented edges [30].

Heated metal objects transfer more heat which is less readily dissipated and cause deeper burns. Direct burns to the nail beds cause linear striae [30].

Electrical shocks may cause small, punctate burns of a size related to the size of the contact points. A single application of an electric shock weapon produces erythematous papules acutely, which fade to hypo-pigmented, circular macules which are characteristically arranged in pairs, 5 cm apart and approximately 0.5 cm in diameter [31]. These injuries usually present as clustered, superficial scabbed lesions early on. Later they may only be discernable as depigmented macules [30]. Electricity applied on either side of the eye can produce corneal burns and blindness [119].

6.4. Criminal torture and interrogation

The line between criminal torture and inflicting burns on children, the elderly or the infirm is clearly arbitrary because all are illegal. This category exists to describe burning injuries to adults who become vulnerable as a result of a sin-

gle criminal act rather than as part of on-going dependence. An example is a father and his 11-year-old son who were kidnapped from their home in Northern Ireland. The father was hooded and bound by a gang who then tortured him with burning cigarettes and demanded a ransom [120].

6.5. Special cases of criminal torture

6.5.1. Burnt wife syndrome (India)

As mentioned above, the practice of Sati was banned in 1829 during the period when India was still a British Colony. Since independence in 1947 only 40 cases of Sati have been recorded officially—and the vast majority of these occurred amongst women from Rajasthan [109]. In 1987, the Sati of an 18-year-old wife, married for only 8 months before her husband’s death, resulted in the family who assisted her Sati being arrested, but after fierce campaigning and a trial delayed for 9 years they were acquitted for lack of witnesses in court [121].

More commonly in modern India is the practice of burning wives, or coercing their suicides by self-immolation, when on-going dowry payments are considered unsatisfactory. This represents enough of a problem for India to have enacted a law prohibiting dowries [122] and then to have modified their penal code in 1986 to provide for imprisonment and fining of those convicted of causing dowry death [123]. However, despite these measures, in the following 4 years between 1987 and 1991 the number of dowry deaths recorded by the Indian National Crime Records Bureau rose almost three-fold from 1912 to 5157 [124]. Kumar reports that 32 (21%) of a sample of 270 deaths from burns in married women in an 18-month period were attributable to self-immolation [125]. The majority of these wives were Hindu (94%); under 25 (69%); poorly educated (75%); living within their husband’s family (69%) and had been married less than 7 years (66%)—the Dowry Act, 1961 covers only the first 7 years of a marriage [125]. Burning is usually achieved by dousing the victim in kerosene, a commonly used cooking fuel in rural areas [125,126]. Das Gupta and Tripathi [127] report virtually identical findings from a different part of India.

Given the Indian experience of such assaults cited above, the vulnerability of a young, poorly educated woman subject to this kind of assault whilst living within a husband’s family and isolated from her own family, and any other form of support, could be far worse if she were further removed from her home to the UK where language may provide a further barrier to help and support. Therefore an investigation of the prevalence of such assaults in the UK is long overdue.

In the North West Regional Burn Unit in Manchester we have seen six cases in as many years in which burning was used as a method of lethal assault on married women who were originally from the Indian sub-continent but then living in the UK. In the same time period none has been noted in unmarried women from the same ethnic groupings, nor

from married or unmarried women from other ethnic groups. However, these observations in isolation are meaningless. We are currently auditing these injuries retrospectively and prospectively for definitive, objective data with particular reference to relative incidence within ethnic groups.

6.5.2. Acid attacks (predominantly Bangladesh)

Since 1996, when there were 47, the number of cases of “acid violence” reported to the Bangladeshi police annually has risen to 338 in 2001 [128]. Most attacks are by men on women, although men are increasingly being attacked with acid rather than guns and knives and disputes between neighbours over garden vegetation have culminated in acid attacks on babies [129]. Estimates of three to five women being attacked daily have been published in the press [130]. In 2002, in response to the epidemic the Bangladeshi Government passed one law controlling the production, importation, storage and use of acid and another providing the death penalty for convicted acid attackers [131]. Data from the Acid Survivors Foundation for 2001 show two women being attacked for each man. The commonest reasons for attacks are disputes over rejected sexual advances or marital disputes (41%); land and family disputes (32%) and dowry dissatisfaction (13%) [132]. Acids rather than alkalis are favoured in these attacks and sulphuric and nitric acid, available at negligible cost in Bangladesh from car batteries, jewellery workshops and leather tanneries are most commonly involved [133].

Acid is used infrequently as a weapon in the UK. However, this unit has experience of the use of most common inorganic acids in assaults and, perhaps most noteworthy, the use of hydrofluoric acid in a lethal assault on a club owner. Hydrofluoric acid in relatively small volumes is rapidly lethal and should be considered if a victim reports being splashed with a colourless liquid which then burns and causes exquisite tenderness. Rapid antidote administration and supportive measures are of the essence.

7. Conclusions

Most forms of Intentionally inflicted burns have higher associated morbidity and mortality than equivalent accidental burns: in part, this may relate to co-morbidity from other physical or substance abuse or from psychological problems that pre-existed and contributed to the inflicted burn or that result from it.

Inflicted burn injuries involving children and the elderly often occur when family carers of low educational attainment and with scant emotional and financial resources, vent their frustrations on a demanding family member: be it an independent, hard to subdue little boy or a confused, hard to subdue elderly parent.

All forms of abuse, especially within families, represent complex behaviours often rooted for the abuser in past dysfunction with origins in poverty, desperation, substance de-

pendency and the abuser’s own previous abuse – possibly, in the case of elder abuse, at the hands of the currently-abused victim. Nevertheless, a deliberately inflicted burn on another human being represents a criminal act and as such must be reported [134]. Intentionally inflicted burn injuries are not simply physical injuries and are best managed within a multidisciplinary team of specially interested and prepared health care, social service and legal professionals.

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