

Burns as a consequence of child maltreatment

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Abstract

Over 25,000 children a year attend emergency departments in the UK with burns. Scalds predominate, with infants aged one year being 10 times more likely to sustain a burn than any other age group. Identifying which burns result from abuse or neglect is challenging, but inflicted injuries are more likely to have certain characteristics and differences in the causative agent, mechanism and pattern of burns have been observed in children with non-accidental burn injuries. Children have been subjected to every type of burn as a consequence of abuse including scalds, contact, caustic, flame and radiation burns, thus careful scrutiny of all burns cases for possible maltreatment is warranted. Whilst neglectful burns outnumber inflicted burns by 9:1, these are most challenging to discern. A detailed history is vital to determine whether the burn pattern is consistent with the child's developmental stage, and the agent and mechanism offered, in addition to evaluating supervision, and previous or co-existent injuries. Social features such as domestic violence in the home or being previously known to social services are also key indicators. If abuse is suspected, full investigations including skeletal survey in those aged less than 2 years is required, consideration of cranial neuro-imaging in younger infants and possible scene assessment.

Keywords distinguishing features; intentional non-scald burns; intentional scalds; maltreatment

Introduction

Burns are a serious public health problem responsible for significant morbidity and mortality worldwide. According to the World Health Organisation (WHO), more than 300,000 people die every year as a result of burn injuries. Almost a third of fatalities are in those younger than 20 years of age: therefore a child dies of burn injuries somewhere in the world approximately once every 5 minutes.

Non-fatal burns vastly outnumber fatal burns, and are a leading cause of morbidity often with long-term physical, psychological and economic consequences. Children are particularly at risk of suffering burn injuries. In the UK, an estimated 25,000

children attend the emergency departments (ED) every year for treatment of burns. Their curiosity and impulsiveness, together with their limited ability to perceive and react promptly and properly to dangerous situations, makes children vulnerable to burn injuries. Furthermore, a child's skin is more susceptible to the detrimental effects of heat as it is much thinner than that of an adult. It takes less than one second for an infant to sustain a full thickness burn from a temperature of 60 °C (0.5 second at 65 °C). Damage to the skin occurs at even lower temperatures with prolonged contact and young skin is susceptible to damage (protein denaturing) at temperatures of just 40 °C.

The highest incidence of childhood burns has been reported in children younger than five years of age, with the greatest prevalence in one year olds. A recent analysis of the age of the youngest children admitted for burns and scalds in the UK and Ireland demonstrated a sharp increase at 8 months, with a peak at around 13 months of age. This age range often correlates with the onset of independent mobility in infants.

Numerous risk factors for burn injury in children have been identified and relate to factors within the child, the family, and the social and physical environment. These include: male gender, low socio-economic status, low educational level of the primary caregiver, and immigrant status. Additional risk factors include: the presence of a pre-existing impairment in the child such as blindness or epilepsy, history of burn injury in a sibling, overcrowding, birth order (children who are not the first born carry a higher risk), absence of water supply, and behavioural difficulties such as attention deficit hyperactivity disorder (ADHD). For many of those living in state-provided housing, they may have no ability to control the temperature of their domestic water, thus supervision becomes even more critical. Others may choose to set the water at a higher temperature, as this may provide cost-saving, but it also creates a higher risk environment.

Childhood burns demonstrate seasonal variation with a higher incidence reported during the colder months. The majority of unintentional burns occur within the home. Most studies report the kitchen as the most frequent site within the home for burns and scalds, with the majority of incidents occurring during food preparation by parents and at mealtimes.

Determining the true prevalence of burns as a consequence of child abuse is difficult. Estimates vary widely, and are partly dependent on whether cases are ascertained from burns unit's admissions (10–24%) or emergency department attendances (10%), being highest for those younger than two years old. Their seriousness is underlined by the fact that burns and scalds are among the top three causes of fatal maltreatment, with abused children experiencing a worse outcome and requiring more skin grafting than those with unintentional burns.

Burns due to child neglect are believed to outnumber those due to abuse by as much as 9:1. It is particularly difficult to distinguish neglectful burns however, as they are essentially accidental burns that should have been prevented, compounded by the fact that they may not have received prompt appropriate first aid or be brought for prompt medical attention. Defining the thresholds between a momentary lapse in attention, inadequate supervision and neglect are challenging. An interesting study by James-Ellison et al., has highlighted the vulnerability of young children who sustain burns. They conducted a case-control study

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of children younger than three years of age who were admitted to a burns unit. Although only 2.8% were attributed to maltreatment, follow up of all cases to their sixth birthday showed that children sustaining unintentional burns before their third birthday, were five times more likely to end up maltreated ($p < 0.004$) and almost twice as likely to become a 'child in need' ($p < 0.006$). This would suggest that either a burn in early childhood indicates vulnerability on the part of the child, or that it may be an indicator of a risky environment. Thus, in addition to identifying those with a burn due to maltreatment, the challenge is to identify which of the thousands presenting with an early childhood burn every year, are in fact living in a high risk environment.

The key elements in assessing burns in children are a careful history, complete physical examination, and consideration of a 'scene' assessment where the burn is purported to have taken place.

While this review will focus on the most commonly reported intentional burns in children, there is almost no form of burn that has not been inflicted on a child – from immersion in boiling water, acid dripped onto their head, burning metal repeatedly pressed against their skin, set alight or micro-waved. It behoves all practitioners to keep an open mind to any possibility when assessing children with burns.

What burns do children sustain?

Childhood burns can be classified into a number of types, caused by a variety of *agents*, different *mechanisms* of injury, each of which produces a specific *pattern* of injury.

Distinguishing characteristics between intentional and unintentional scalds

A scald occurs when the skin is exposed to hot liquids or steam. Approximately 60% of all burns in children are caused by scalds, with hot beverages or cooking liquid being the most frequent *agent*. The *mechanism* of unintentional scald injuries varies with age. Younger children are more likely to pull hot drinks or containers of hot water down on themselves from a kitchen counter or table while older children frequently suffer scalds as a result of spills during food preparation or from steam. The *pattern* of injury sustained from a typical 'pull over scald' includes burns to the upper limb, neck, head, and upper trunk (Figure 1), with 80% being asymmetric and on the anterior surface of body. Classically, these scalds have an irregular margin, and varying burn depth, with the deepest burns sustained by the first point of contact, and decreasing depth as the liquid travels down the body, losing heat. Accidental immersion scalds tend to occur when toddlers put their hand into a cup or bowl containing hot liquids. Although rare, a small case series of flowing water scalds, i.e. where the child turns the hot tap on themselves, identified that they are likely to affect the limbs asymmetrically, with the limb closest to the hot tap significantly more severely affected. They have irregular margins, with varying burn depth, usually anterior on the lower limbs. In contrast, *abusive scalds* are predominantly caused by hot water, with the classic injury being an immersion injury. The classical *pattern* of injury here involves lower limbs, with or without buttocks, including a clear upper margin and uniform burn depth (Figure 2). There may be



Figure 1 Unintentional pull over scald.



Figure 2 Intentional immersion scald.

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