

# Assessment and management of scalds and burns in children

Eleanor Hollywood and Tracey O'Neill explain why it is important for nurses involved in the care of such traumas to have good knowledge of the pathophysiology of this type of injury and the associated physical and psychological consequences

## Abstract

In childhood, burn or scald injuries are comparatively common, and the greatest risk is to infants and toddlers. The extent and severity of injuries can vary greatly, which can significantly affect recovery and outcome. To provide high quality nursing care to the child who has sustained a burn injury and the family, the children's nurse should understand the pathophysiology of the trauma and the associated physical and psychological suffering. Evidence-based nursing management of these aspects is an essential component of recovery. Children's nurses working in hospitals, schools or in the community can engage with parents, families, school staff and children to provide information, advice, and health and safety promotion for burn prevention.

## Keywords

Accidents and emergencies, accident prevention, burns, children: accidents, child nursing care, first aid

effects on the child's life. Childhood injury prevention is a worldwide concern (Parbhoo *et al* 2010), but accidental scalds and other burns are largely preventable (Atiyeh *et al* 2009).

## Clinical history

The nursing care of the child who has sustained a scald or a burn includes making a meticulous record of the details of any injury (Warner *et al* 2012), incorporating clinical and social history, as well as burn mechanism and thermal agent (Maguire *et al* 2008). The children's nurse should collate information about the items outlined in Box 1 to obtain a comprehensive record.

## Referral

Criteria for referral to a specialist burns unit vary. However, the British Burns Association (2012) has outlined a minimum threshold for referral of a patient to a specialist burn care service. These criteria for referring a child with burn injuries are listed in Box 2. During the assessment phase of caring for the child who has sustained a burn, the speedy establishment of a communication link with the nearest specialist burn care service is invaluable to ensure the child receives the most up-to-date evidence-based care and management.

## Burn depth

The depth of burn is crucial, because it will determine how the injury is treated. However, many burns vary greatly in depth, so assessment can be difficult. The skin is made up of three distinct layers: the outermost epidermis layer and the dermis layer, which is anchored to the subcutaneous layer. Table 1 (page 30) outlines the classification of burn depth and the affected skin layers.

BURNS ARE some of the most devastating injuries that can be sustained by the human body. Such traumas occur when there is skin contact with hot liquid, hot surfaces/objects, chemicals, radiation or electricity (Yates *et al* 2011); skin damage can also result from cold and friction injuries.

Scalds are the most common burn injury seen among children in the UK (Egro *et al* 2010, Warner *et al* 2012) and Ireland (Dempsey and Orr 2005, Yates *et al* 2011). A splash scald is non-uniform in shape and distribution, and has a mixed depth; an immersion scald is more uniform in appearance and usually there are no splash marks. Figure 1 shows examples of scald and burn injuries.

Global studies demonstrate that children aged 0-4 four years have the highest incidence of burn injuries (Rayner and Prentice 2011). A toddler can sustain a severe scald from something as simple as an unattended cup of hot tea, and such trauma can occur in seconds, yet its consequences can have significant physical, emotional and psychological

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**Figure 1** Burn and scald injuries



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A burn injury (top) and a scald injury (bottom) on the arms of children aged under four years

### First aid and assessment

Adequate first aid following burn injury improves outcome (Graham *et al* 2012). However, although there are various public health guidelines advising on best first aid treatment, there is a lack of knowledge about this among parents. A UK study by Graham *et al* (2012) found a significant need to improve parental education and awareness of burns first aid, and a Turkish study by Karaoz (2010) found parental knowledge of appropriate first aid treatment of burns considerably lacking.

The primary objectives of first aid with burns are to (Cuttle and Kimble 2010):

- Stop the burning process.
- Provide pain relief.
- Halt the progression of the burn.
- In the UK, prevention of infection is also one of the primary aims.

The use of cold running water for 20 minutes to remove heat energy from the area is recommended as the first-line treatment. Ice must not be used as a cooling measure as it constricts capillaries (McQueen *et al* 2012).

Subsequent nursing care depends on a number of variables: the child's age, the depth of burn, percentage of total body surface area (TBSA) affected,

### Box 1 Information required for detailed history of a child with a scald or burn

|          |   |
|----------|---|
| Clinical | <ul style="list-style-type: none"> <li>■ The child will be initially assessed for airway, breathing and circulation.</li> <li>■ Temperature, heart rate, respiratory rate, blood pressure and oxygen saturations will be recorded.</li> <li>■ Is the burn covered or exposed?</li> <li>■ Was any first aid treatment given to the child?</li> <li>■ Are there any signs and symptoms of inhalation injury?</li> <li>■ Are there any signs of shock?</li> <li>■ Does the child appear to be in good condition, with clean hair, skin and nails?</li> </ul>   |
| Social   | <ul style="list-style-type: none"> <li>■ At what time did the child present for treatment?</li> <li>■ What age is the child?</li> <li>■ Who has brought the child for treatment?</li> <li>■ Who does the child live with normally?</li> <li>■ Does the child go to school/playschool/crèche?</li> <li>■ Has the child been in hospital before?</li> <li>■ Has the child received treatment for injury or illness before?</li> <li>■ Has the child reached normal developmental milestones?</li> <li>■ Condition on arrival for treatment, for example, crying, inconsolable, whimpering, or withdrawn.</li> </ul> |
| Injury   | <ul style="list-style-type: none"> <li>■ When did the burn occur (exact time)?</li> <li>■ Where was the child at the time?</li> <li>■ Who was with the child?</li> <li>■ What agent caused the burn to the child?</li> <li>■ How exactly did it happen?</li> </ul>  |
| Wound    | <ul style="list-style-type: none"> <li>■ Record the site of burn injury.</li> <li>■ Using the Lund and Browder chart (child version) (Bosworth 1997) record the extent of the burn (percentage of total body surface area).</li> <li>■ Describe the distribution of the burn.</li> <li>■ Describe the depth of the burn.</li> <li>■ Describe the colour of the burn.</li> </ul>   |

### Box 2 Guidelines for referring a child to a specialist burn care service

- Inhalation injury.
- All burns  $\geq$  2% of total body surface area.
- All full-thickness burns.
- All circumferential burns.
- Any burn not healed in two weeks.
- Any burn with suspicion of non-accidental injury.
- All burns to the face, hands, feet, perineum or genitalia.
- Any chemical or electrical burns.
- Any unwell/febrile child with a burn.
- Any concerns about comorbidities that may potentially affect the healing process and outcome.

(Adapted from British Burns Association 2012)

**Table 1** Classification of burn depth

|                    | Superficial | Superficial/dermal            | Deep dermal                 | Full thickness                                 |
|--------------------|-------------|-------------------------------|-----------------------------|--|
| Epidermis          | Affected    | Affected                      | Affected                    | Affected                                       |
| Dermis             |             | Outer part of dermis affected | Much of the dermis affected | All of the dermis affected                     |
| Subcutaneous layer |             |                               |                             | Some or all of the subcutaneous layer affected |

(Fenlon and Nene 2007)

**Table 2** Requirements for maintenance fluids

| Weight (kg) | Intravenous fluid                                 |
|-------------|---|
| 3-10        | 100mL/kg  |
| 11-30       | 1,000mL, plus 50mL/kg for each additional kg>10kg |
| >30         | 1,500mL, plus 20mL/kg for each additional kg>30kg |

(McQueen *et al* 2012)

location of the burn, and any associated injuries (McQueen *et al* 2012). The main aspects to address include: fluid resuscitation, nutritional support, pain relief, wound management and psychological care. The core aim of treatment is to restore form, function and feeling to the injured area and promote physical, psychological and emotional recovery (Hettiaratchy and Papini 2004).

### Fluid resuscitation

Children who have sustained burns of greater than 10% TBSA (excluding erythema) require formal intravenous (IV) fluid resuscitation to prevent burn shock (Fenlon and Nene 2007, Williams 2011). Fluid loss begins immediately after the burn occurs, therefore fluid resuscitation should start from the time of the injury and not from time of admission (McQueen *et al* 2012). Children have limited physiological reserves; therefore fluid resuscitation must be more precise than for an adult with a similar burn (Sharma and Parashar 2010).

Thermal damage to the skin leads to an increase in capillary permeability, causing a general shift of fluid from the intravascular compartment to the interstitial fluid compartment (Hettiaratchy and Papini 2004), resulting in major fluid loss. As a result, there is a reduction in circulating blood volume, which must be corrected to restore and maintain oxygen delivery

to all body tissues that have been damaged by loss of sodium, proteins and water (Williams 2011).

Fluid resuscitation is generally carried out intravenously; therefore adequate IV access must be established as soon as possible (Williams 2011). The most commonly used fluid resuscitation formula in practice is the Parkland Formula (Urdiales-Baker *et al* 2011), which is:

$$4\text{mL} \times \text{bodyweight (kg)} \times \% \text{ TBSA burned.}$$

This formula calculates the total fluid required for the first 24 hours of resuscitation, where half is administered in the first eight hours after injury and the remainder over the following 16 hours.

Crystalloid fluids are generally used; however, there is continuing debate about using colloids in fluid resuscitation. The decision remains with the treating physician (Urdiales-Baker *et al* 2011).

The child should also receive hourly maintenance IV fluid in addition to the resuscitation fluid (Hettiaratchy and Papini 2004). Infants are especially at risk of developing hypoglycaemia because of limited glycogen stores; as a result, nursing care should include monitoring glucose levels (Sharma and Pashar 2010). Table 2 outlines how to calculate the amount of fluid required for IV fluid maintenance.

Nursing skills should include care of the child on an IV infusion and the IV site. An IV cannula should be removed if there are signs of infection, phlebitis or infiltration, or if the cannula becomes blocked (Ingram and Lavery 2007). The children's nurse should also maintain an accurate fluid balance record, recording all types of input and output (Green and Huby 2010).

### Nutritional support

Children with burns have significantly increased calorie requirements due to the development of a hypermetabolic state (Sharma and Parashar 2010). This can result in delayed wound healing, organ dysfunction, susceptibility to infection and ultimately death (Saffle and Graves 2007).

Early enteral feeding is essential for the acceleration of healing and prevention of complications however, as feeding by mouth or nasogastric (NG) tube increases, IV fluid support should be reduced (Glasper *et al* 2010, Khorasani and Mansouri 2010). Some children will be able to eat, but those with >10% TBSA burns will require a nutritional assessment by a dietitian as a consequence of their inability to meet their calorie requirements. These children may also need NG tube placement for supplemental enteral feeding (McQueen *et al* 2012).

Nursing care of the child requiring NG feeding is summarised in Box 3.

## Pain assessment and management

Every child who sustains a burn will experience pain and distress, irrespective of the cause, depth or size of the burn (Gandhi *et al* 2010, Butcher and Swales 2012). As the injury heals, the child will experience other forms of discomfort, such as itchiness (Fenlon and Nene 2007).

Pain management and alleviation of discomfort are critical elements in the overall nursing care of a person with a burn. A multidisciplinary child- and family-focused approach should be adopted to combine pharmacological and non-pharmacological pain-relieving interventions (Ratcliff *et al* 2006, Gandhi *et al* 2010). To manage pain effectively, children's nurses should be aware of the different types of pain associated with burn injury.

Inadequate pain management can have adverse physiological and emotional effects on the child, so effective pain control is crucial for improving outcome (Gandhi *et al* 2010). Continuous and accurate assessment of pain is the key to successful treatment (Gandhi *et al* 2010). However, this can be difficult in infants and children, and the child's age, developmental level, cognitive and communication abilities and previous pain experiences must all be considered. There are various pain assessment tools for children that nurses can use to assess, plan, implement and evaluate appropriate pain management and care.

The most popular methods used to measure pain intensity include self-reporting tools, and behavioural and physiological measures (Srouji *et al* 2010). Self-report tools are considered the most valid measure and are suitable for verbal children over the age of four years (Jacob 2011). Behavioural and physiological pain measurement tools consist of assessment of vital signs, crying, facial expressions, body postures and movement, and are used generally for children from infancy to four years of age, where communication is difficult (Srouji *et al* 2010, Jacob 2011).

### Box 3 Primary care aspects for a child requiring nasogastric feeding

- Correct placement of a short-term PVC nasogastric tube.
- Check tube placement with pH indicator paper before each use.
- Maintain accurate fluid balance chart.
- Follow dietitian's feeding regimen precisely and report child's tolerance.
- Stop feed immediately if there are signs of breathing difficulties.

(Clynes and O'Connor 2010)

The Wong-Baker FACES® Pain Rating Scale is a self-reporting tool that combines facial expressions, numbers and words. The children's nurse explains what each face represents and asks the child to choose the face that best describes the pain (Wong and Baker 1988).

The FLACC scale is a behavioural pain assessment tool that consists of five categories:

- F Face.
- L Legs.
- A Activity.
- C Cry.
- C Consolability.

It provides a simple and consistent method of pain assessment in non-verbal or preverbal children. Each of the five categories is scored between zero and two, and provides a total score of between zero and ten (Merkel *et al* 1997).

The Itch Man Scale is specific for burns and uses pictures based on children's personal drawings of their itch discomfort. The drawings create a score of the severity of the itch, using a five-point Likert scale to rate intensity (Marvin and Blakeney 2000).

**Pharmacological pain relief** Pharmacological approaches to pain management are the mainstay of treatment for a child with a burn injury. In the initial resuscitative period, IV opioid analgesia can be administered for pain relief (Sharma and Parashar 2010). Background pain between wound-care procedures can be managed with regular analgesia (Connor-Ballard 2009). Procedural pain, which is more severe than background pain and can be excruciating, requires more intense analgesia pre-procedure (Connor-Ballard 2009, Gandhi *et al* 2010).

Poorly controlled procedural pain can cause the child to experience anticipatory anxiety, whereby the fear of pain increases before a procedure begins, which goes on to lower the pain threshold and cause hypervigilance (Wiechman-Askay *et al* 2009). Sedation should not be administered routinely but, if a child is particularly anxious or frightened, this may be necessary (Nilsson and Renning 2012).

**Non-pharmacological pain relief** Alternative interventions for pain relief can be effective for treating children's pain if used in combination with analgesia. They include strategies such as covering the burn so air movement cannot irritate the exposed nerve endings and cause further pain (Ball *et al* 2010). In the UK, other strategies such as breathing exercises and relaxation techniques for children have also been found helpful, and guided imagery, distraction (Jacob 2011) and technology-based preparation (Miller *et al* 2010) are widely used.



**Table 3 Dressings used for scalds and other burns in children**

| Dressing                             | Description  | Frequency of dressing change   | Use   |
|--------------------------------------|--|--|---|
| Low adherence or occlusive dressings | Laid directly on the wound; allow exudate to move through from the wound bed. Low adherence, minimal pain on removal | Every 5-10 days, change of secondary layer as required                                       | Superficial burns with minimal exudates   |
| Foam dressings                       | Used as secondary dressings  | Change as needed depending on the amount and nature of exudates                              | Used for exuding wounds. Secure in place with crepe bandage   |
| Soft gauze                           | 100% cotton non-fibre shedding gauze used over the occlusive dressings   | Change as needed depending on the amount and nature of exudates                              | Used to absorb, cushion, protect, and hold primary dressings in place. Secure with tape or bandage      |
| Hydrocolloid dressings               | Soak up exudate and form a gel that keeps the wound warm and moist   | Up to every seven days, depending on exudates  | Partial-thickness burns   |
| Antimicrobial creams                 | Used in conjunction with dressings to reduce the risk of bacterial infection of a wound                              | Replace every 24 hours or more frequently if excessive exudate                               | For full- or partial-thickness, hand and perineal burns, must use 3-5mm thickness.                      |
| Silver dressings                     | Layered nanocrystalline silver dressings   | Change dressing every three or seven days or more frequently if excessive exudate is present | Used for deep partial-thickness and full-thickness burns, at-risk donor sites and graft recipient sites |

(O'Sullivan *et al* 2010, McQueen *et al* 2012)

The children's nurse should ensure that the family is involved in helping the child to use pain-relieving strategies and that care is planned with parent and child participation. A family-centred approach helps to reduce the adverse effects of hospital admission and therefore forms the cornerstone of care for all infants, children and young people who require hospital treatment (Jolley and Shields 2009).

### Wound management

After initial stabilisation of the child, attention must be directed towards wound management, which, in the case of burns, aims to prevent infection and

promote complete wound closure as soon as possible (Sharma and Parashar 2010). Areas for consideration include wound cleansing, debridement and dressing selection, and the children's nurse plays a crucial role in these care aspects (Krishnamoorthy *et al* 2012).

**Cleaning and debridement** Nursing care includes cleansing and debridement of the wound using soap and water or mild antibacterial wash (Alsbjorn *et al* 2007). This allows for better inspection of the wound surface and removal of necrotic tissue, exudate and application of topical preparations (Krishnamoorthy *et al* 2012). Debridement is performed using gentle mechanical techniques such as brushing or scraping (Krishnamoorthy *et al* 2012). However, in children with large, full-thickness burn wounds, early excision of dead tissue should be carried out as soon as the child is stable to prevent complications (Urdiales-Baker *et al* 2011); this may require anaesthetic cover. Protocols for excision of eschar vary and nurses must adhere to local policies.

Burn blisters form when the epidermis separates from the dermis. This occurs as a physiological response to the injury. There are many theories on the management of burn blisters and many approaches to care, but there is no consensus about the most effective treatment. Edwards (2011) describes the three most common ways of managing burns blisters:

- Leave the blister intact.
- Aspirate fluid from the blister, leaving the devitalised epidermis intact.
- Deroof the blister, removing the epidermis.

**Which dressing?** After debridement and blister management, the wound must be assessed and covered, and children's nurses play an important part in dressing selection and maintenance. However, because of the complexity of burn management, this aspect of care will require an integrated multidisciplinary approach. Selig *et al* (2012) suggest that the ideal burn wound dressing must meet the following criteria:

- Be non-adhesive.
- Be absorbent.
- Have antimicrobial properties.
- Be easily removable.
- Guarantee pain-free dressing changes.
- Be available in a range of sizes.

The dressing should also provide the right environment to promote healing (Baranoski 2008) and, although a range of dressings and antimicrobial creams is available, there is no consensus on which is the best. The choice, therefore, depends on cost, availability and frequency of dressing changes

(McQueen *et al* 2012). Table 3 outlines some of the most commonly used dressings for scalds and other burns in children (O'Sullivan *et al* 2010, McQueen *et al* 2012).

## Psychological care

A burn injury is a traumatic experience for a child and the family, and requires long-term individualised psychological and emotional support. The child may exhibit signs of extreme anxiety as a result of the initial trauma, repeated exposure to painful procedures, possible separation from parents/carers during procedures and the effects of long-term hospital stay (McQueen *et al* 2012). The parents of the child will also require emotional and psychological support as they may experience feelings of shock, guilt and anxiety and undergo temporary disruption of family relationships (Williams 2011).

The children's nurse can use the following pointers to help manage the psychological aspects associated

with caring for the child who has sustained a scald or a burn:

- Involve family members in care and decision making, as this will enhance recovery and promote empowerment.
- Provide clear, concise information for the child, parents and carers to ensure understanding and reduce anxiety.
- Adopt a family-centred approach, as this will alleviate the child's and family's fear and anxiety.

## Conclusion

The children's nurse plays an important role in the hospital care of the child who has sustained a burn, as well as in the education and promotion of burn prevention in childhood. Children's nurses who work in hospitals, schools or in the community are well positioned to engage with parents, families, school staff and children to provide practical advice and health promotion for burn prevention.

## Online archive

For related information, visit our online archive and search using the keywords.

### Conflict of interest

None declared

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