Pediatric Burn Care
Unique Considerations in Management

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KEYWORDS

• Pediatric burn • Pediatric burn resuscitation • Pediatric burn wound care
• Pediatric burn management • Pediatric burn nutrition

KEY POINTS

- Pediatric patients with partial-thickness burns greater than 10% total body surface area (TBSA); burns of the face, head, neck, hands, feet, or genitalia; concern for intentional injury; or electrical or chemical burns should be referred to a burn center.
- Children have physiologic and psychosocial differences from adults. The Lund-Browder chart is used to estimate TBSA. The Schofield equation is used to estimate pediatric energy expenditure. Fluid requirements are estimated: 2 mL times percent of TBSA times weight in kilograms.
- Children have small airways and should be intubated immediately with a low-volume cuffed endotracheal tube if there is inhalation injury.
- Sedation and analgesia should be implemented for dressing changes to reduce pain and psychological trauma.
- Early involvement of child psychiatry, child life specialist, and therapists for the child and family is recommended.

INTRODUCTION

Burn injuries are one of the top 10 causes of unintentional deaths in children younger than 14 years old with 3892 deaths of children 0 to 14 years old reported from 2004 to 2014.[1] Most pediatric burns are minor but children with severe burns have higher mortality than nonelderly adults with similar burns.[2] Although the basic principles of burn management for pediatric patients are the same as for adults, there are key differences in the physiology and psychology of the pediatric patient. Children with severe burn injuries are best treated at a pediatric burn center that offers multidisciplinary support.

The most common types of burns experienced by young pediatric patients are thermal burns from scalding or contact with hot foods. Nonfood-related thermal burns can come from fireworks, irons, curling irons, campfires, and fire pits. Chemical burn injuries occur from topical or mucosal contact with acidic or alkaline products as seen in many common cleaning products. After enactment of the US Poison Prevention Packaging Act in the 1970s, the incidence of chemical burns decreased.[3] Electrical burns are more often seen in adolescents and occur in the setting of exposure to live electrical wires from high-voltage lines or appliances, lightning, or faulty wiring. These burns cause little visible injury because most of the injury

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occurs in the deeper tissues and can also result in nerve and muscle damage and arrhythmias. Electrical burn to the commissures of the mouth can be seen when an electric cord is placed in the mouth by toddlers, leading to tissue destruction and contracture formation.[4]

INITIAL EVALUATION

Evaluation of pediatric burns occurs in different settings, ranging from an outpatient pediatrics clinic to a regional burn center. Triage involves consideration of factors, including age and medical history of the child, severity of the burn, and mechanism of injury.

Initial Triage

Children with an uncomplicated medical history and minor burns that are less than 5% total body surface area (TBSA) for partial-thickness or 2% TBSA for full-thickness thermal burns can be treated in the outpatient setting, including a pediatric or family practice clinic or urgent care clinic. If there is involvement of the face, head and neck, hands, feet, or genitalia; or if there is a concern for abuse, the child should be referred to a burn center. Children with greater than 10% TBSA burns demonstrate systemic physiologic alterations as a response to the burn and should be referred to a burn center for evaluation and treatment.[4] The American Burn Association guidelines for referral to a burn center for children states that any burned child in a hospital that does not have "qualified personnel or equipment for the care of children," including the ability for safe pediatric sedation, should be referred to a burn unit.[5]

Estimating the Severity of Burns

The Lund-Browder chart is used for estimation for TBSA of burns in children. The body surface area (BSA) varies with age; as the child ages, the BSA for the head decreases, whereas the BSA percentage for the legs increases. Superficial (first-degree) burns are not incorporated into the calculation of the TBSA. Infants and young children have thinner dermis than adults, so the extent of the burn may not be evident at first presentation and reevaluation after 48 hours is needed (**Fig. 1**).

The mechanism of burn injury should also be noted and taken into account when estimating the child's total trauma burden. Burns that occur in closed-spaces, such as house fires, may have an associated inhalation injury. Children burned in motor vehicle collisions or other blunt trauma mechanisms can have associated brain, thoracic, abdominal, and/or extremity injuries.

Emergency Department Evaluation

The initial evaluation of a child in the emergency department with burn injuries should begin with airway, breathing, circulation, disability, and exposure (the ABCs). Information from the transport team and family includes time and mechanism of injury, patient demographics and medical history, the amount of prehospital fluid received, immunizations, and medications received thus far. Burn injuries that occur in closed-spaces have a high risk of inhalation injury. Stigmata of inhalation injury include facial injury, singed nasal hair, soot in the airway, stridor, hoarseness, and carbonaceous sputum. The airway should be immediately secured via a cuffed endotracheal tube if there is evidence of an inhalation injury. Depending on the development level of the child, the only signs of distress may be restlessness and irritability. All clothing and jewelry is removed to prevent continued damage to the skin. The room is warmed to prevent hypothermia and the patient is covered with a clean sheet as needed.

If possible, intravenous access is obtained in intact skin or, if not, through the burned skin. Intraosseous access can be used if adequate intravenous access cannot be obtained. A patient with burns greater than 15% TBSA, inhalation injury, intubated, or requiring multiple debridements will likely require a central line.

Estimation of TBSA is performed using the Lund-Browder chart. Burns that are circumferential around the chest should be noted due to the risk of the burn eschar interfering with the ability to ventilate, necessitating escharotomies. Compartment syndrome of the extremities can occur with circumferential burns of the extremities requiring escharotomies and fasciotomies. If there are burns on or near the face, evaluation for corneal burns should be performed with fluorescein before eyelid edema prevents thorough examination.

Fluid resuscitation is started in the emergency department using Normosol or lactated Ringer solution. There are different formulas for determining the amount of fluid needed for resuscitation. The commonly used Parkland Formula is total fluid over 24 hours equals 4 mL times percent of TBSA times weight in kilograms. Half of the total fluid is given in the first 8 hours and the second half is given over the next 24 hours. The Modified Brooke formula is total fluid over 24 hours equals 2 mL times kg times percent of TBSA. Half of the total fluid volume is given in the first 8 hours and the other half over the next 16 hours. The amount of fluid given in transport before arrival is used in the calculation of total fluid given. Patients with combined burn and inhalation injuries may have