Emergency Care of Pediatric Burns

Ashley M. Strobel, MD[a,*], Ryan Fey, MD[b]

KEYWORDS

• Burn • Inhalation injury • Resuscitation • Total body surface area • Abuse • Emergency • Scald

KEY POINTS

- The emergency department fundamentals of pediatric burn resuscitation are early airway management, accurately calculating the total body surface area (TBSA) involved, fluid resuscitation, evaluating the patient for concomitant trauma or toxicity, and appropriate disposition.
- Airway management should be considered in younger children (<2 years old) with larger (>20% TBSA) scald injuries, as well as in children with flame or inhalational injury.
- Intravenous fluid resuscitation should be initiated for children with greater than or equal to 15% TBSA affected by partial-thickness or full-thickness burn within 2 hours of injury.
- Risk factors for mortality in burned children are a larger TBSA, inhalation injury, multiorgan failure, age less than 4 years old, and nonaccidental burn.

In the United States, injuries continue to be the leading cause of death among children. Of these deaths, 0.7% are caused by fire or burns, which is similar in prevalence to deaths from poisoning.[1,2] From the 1970s to the 2000s, the reported number of burn-related injuries trended downward 30% to 50%.[2–4]

Approximately 90% of pediatric burns occur at home,[2–8] whereas adolescents are about 3 times more likely to get burned outside the home.[3] The type of burn injury is related to the child's age and developmental stage.[2] Toddlers and preschool children sustain majority of scalds, intraoral burns, and electrical injuries.[5,6,8–21] Boys are burned more often than girls.[2,3,5–13,17–20,22–25] Scalds are more common in younger children and flame burns are more common in older children.[8,13,22]

The overall mortality rate is 0.4% to 2.8% among burned children.[8,16,22,23,26,27] Death is very rare in children who have been scalded; however, mortality increases

Neither A. Strobel nor R. Fey has any financial disclosures.

[a] Department of Emergency Medicine, University of Minnesota School of Medicine, Hennepin County Medical Center, University of Minnesota Masonic Children's Hospital, 701 South Park Avenue R2.123, Minneapolis, MN 55414, USA; [b] Department of Surgery, University of Minnesota School of Medicine, Hennepin County Medical Center, 701 South Park Avenue, Minneapolis, MN 55414, USA

* Corresponding author.

E-mail address: Ashley.strobel@gmail.com

Emerg Med Clin N Am 36 (2018) 441–458

https://doi.org/10.1016/j.emc.2017.12.011

emed.theclinics.com

significantly in cases of pediatric abuse, possibly because of concomitant injuries.[25,28] Fire and flame-induced burns account for most of the fatalities.[2,23] Larger total body surface area (TBSA) burns tend to be due to injuries related to exposure to flames.[23,29] Multiorgan failure increases mortality, with 3 failed organs being nearly universally fatal[30] (**Box 1**). Despite these mortality risk factors, long-term outcomes are optimistic provided the child has access to multidisciplinary specialty care.[31,32]

DEPTH OF THE BURN

Burns are categorized as superficial (first degree), partial-thickness (second degree), full-thickness (third degree), or those involving deeper tissues or structures (fourth degree) (**Table 1**). Most of the burns in children are classified as partial-thickness.[2,9] A burn may have multiple-thickness components, with the deepest part of the burn typically in the center. The burn depth is proportional to the source temperature, consistency, and duration of contact. Thicker, sticky substances (eg, noodles, oatmeal) stay in contact with the skin longer, causing deeper burns. The depth of the burn might evolve and deepen in the first 24 to 48 hours and requires reevaluation.

TYPES OF BURNS

Scalds

In 1977, tap water scald burns constituted half of scald burns.[33] Recommended bath water temperature is 37.8°C; however, 80% of homes tested in Seattle had unsafe hot water temperature (>54°C). For children less than 6 years old, full-thickness epidermal burns can occur within 60 seconds of exposure to water higher than 53°C and within 1 second if the water is hotter than 70°C.[2,33] Standards changed such that new hot water heaters have a maximum temperature preset of 49°C.[34] Currently, hot beverages are the most common cause of scalds.[3,5,7,8,13,16,19,35] In younger children, a bib pattern distribution is sustained when the child pulls a container of hot liquid down from a higher surface (**Fig. 1**).[14]

Contact Burns

Contact with hot surfaces is another common cause of burns among children, especially those younger than 5 years old. Contact burns are often on the upper extremity, specifically the hand.[20] Common sources of contact burns are glass-front fireplaces, oven doors, hair iron products, and irons.[9,20]

Box 1
Factors that increase mortality risk in burned children

- Presence of inhalation injury
- Larger TBSA burned (≥60% signifies a poor prognosis)
- Age less than 4 years
- Burn injury caused by nonaccidental trauma
- Multiorgan failure (especially liver and renal)
- Emerging multidrug-resistant organism sepsis

Data from Refs.[4,8,16,22,23,28,30]