

January 2008

The American Burn Association (2007) estimates that 500,000 people with burn injuries require medical care each year. Approximately 40,000 of those injuries necessitate sustained hospitalization, while an average of 4,000 people die either as a result of the burn or from later complications. During 2003 in Texas, injuries related to fire and smoke were the fifth leading cause of injury related hospitalizations (Jones, Johnson, Hellsten, & Mathabela, 2004).

The unique and enduring needs of childhood burn survivors in particular require continued research and support by the medical and psychological community. Children make up over 30% of United States burn injuries, while newborn to 4 year olds account for over 40% of childhood burn injuries (Stoddard et al., 2006). Hamming and Ogletree (2006) reported that 78,000 children in the United States aged birth to 4 years old were treated annually for burn injuries during 1997-2002. Food related burns (exposure or contact with hot foods/liquids, contact with ovens, etc.) accounted for 40% of the injuries, clothing and curling irons accounted for 23% and other sources (cleaners, light bulbs, etc.) made up 37%. The American Burn Association (2006) reports that “the less than age 2 group unfortunately remains a high risk population for sustaining a burn injury.”

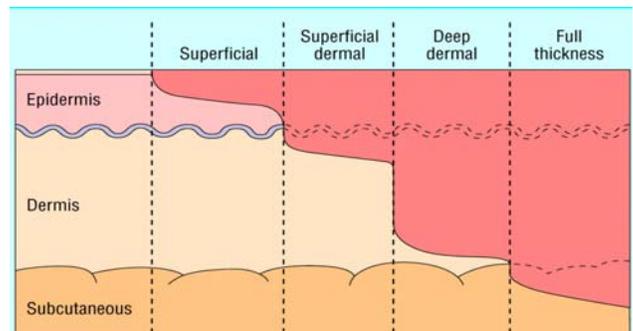
### Burn Assessment

A burn is defined as “tissue damage caused by...heat, chemicals, electricity, sunlight, or nuclear radiation. Most common are burns caused by scalds, building fires, and flammable liquids and gases” (NIGMS, 2006). Burn injuries are evaluated/classified by both thickness and size:

- *Thickness*: refers to the depth of the tissue damage and is rated from first to fourth degree

Burn Depth Chart			
Degree	Type	Damage	Appearance
<i>First</i>	Superficial	Epidermis	Red/Pink
<i>Second</i>	Partial-Thickness (Superficial or Deep)	Epidermis and Dermis	White to Red, blisters and swelling
<i>Third</i>	Full-Thickness	Destroys Epidermis, Dermis, and underlying tissue	White to Black, swelling, dry, leathery
<i>Fourth</i>	Full-Thickness	Destroys all skin layers and often muscle and bone	Charred

(Mendez-Eastman, 2005)



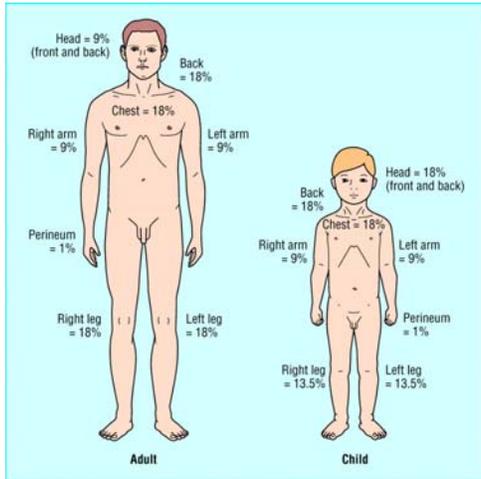
(Hettiaratchy, S. and Papini, R., 2004)

- *Size*: refers to the extent of area of the body damaged and is expressed as a percentage of total body surface area (TBSA) based on one of the following methods (see Hettiaratchy, S. and Papini, R., 2004 unless otherwise cited):

- Palmer surface: a person’s palm is about 1% of TBSA. Palmer surface can be used to estimate extent of burns by measuring
  - Burned area in small burns (less than 15% TBSA)
  - Unburned area in large burns (more than 85% TBSA)
  - Not accurate for medium size burns

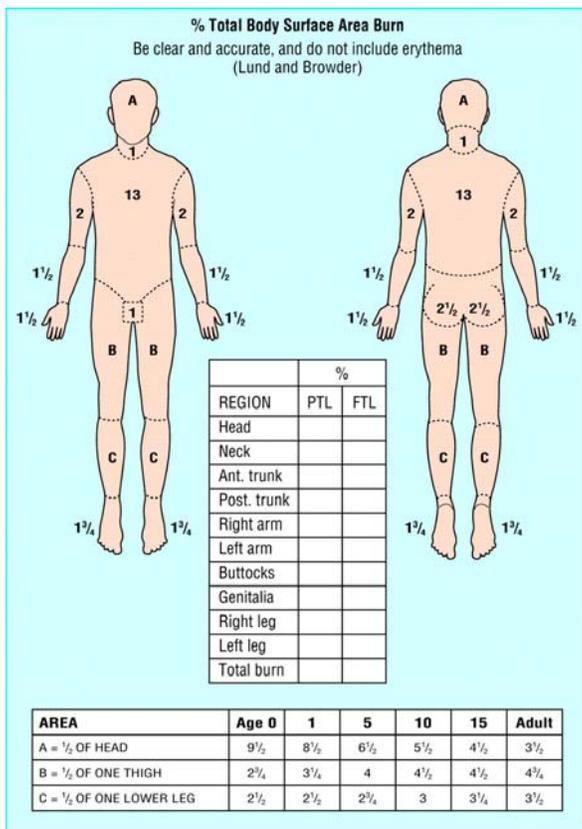


- Wallace Rule of Nines: a body is divided into areas each representing 9% of TBSA
  - Using a chart to diagram injury, total burn area can be calculated
  - Best used for quick, easy estimates of medium size burns in adults
  - Not accurate in children



(Hettiaratchy, S. and Papini, R., 2004)

- Lund and Browder chart: compensates for the variation in body shape with age
  - Most accurate method
  - Preferred method for children



(Hettiaratchy, S. and Papini, R., 2004)

### Physical Complications from Burns

Following the initial severe burn injury, painful and life changing complications are likely to affect the skin, as well as other organ systems. Physical complications are especially challenging in pediatric patients because the growth and maturation process complicates the long-term healing of their burns (Burn Survivor USA, n.d.). Potential physical burn complications include (see Orlando Regional Healthcare, 2004 unless otherwise cited):

- *Skin Injury.* Children have thinner skin than adults; as a result, burns cause serious, long-lasting damage. Burns to the skin may result in loss of body heat, inability to regenerate healthy skin, and risk of infection depending on the severity of the burn.
- *Circulatory System.* After a burn, the output of the cardiac system can decrease up to 30%. This effect typically lasts up to 36 hours before returning to normal. Damage to the cells also lowers the body's ability to balance fluids and electrolytes, temporarily reducing circulation to the burn area and other vital organs.
- *Respiratory System.* Complications in the lungs occur most frequently in burns situations also involving the inhalation of smoke or carbon monoxide and can lead to lowered respiratory function all the way to respiratory failure.
- *Digestive System.* Due to lowered circulation, potential exists for ulcers, hemorrhages, and perforations.
- *Endocrine System.* An abundance of post-injury hormones depletes calories and energy at about three times the normal rate, despite the body being at rest. Lasting a few hours to 12 days, nutrients must be replaced to avoid lost protein and muscle mass at the burn site or it may never be regained.
- *Immune System.* Weakened body systems combined with poor nutrition decrease overall immune function, potentially leading to serious infections at the wound site and in other vital organs. Lowered immune function due to malnutrition may increase the incidence of diabetes, seen more often in pediatric burn patients than adults. The lack of glucose breaks down important muscle tissue, reducing energy and slowing healing time. Recent research suggested that regular treatments of fenofibrate for two weeks significantly improved glucose

uptake in children with burns on more than 40 percent of their total body surface area (Medical News Today, 2005).

### Physical Treatment of Burns

Initial treatment for burns includes removing hot and burned clothing, cooling and cleaning the burn site, administering necessary medications, and covering or dressing the wound (Mendez-Eastman, 2005). Long-term treatment for severe burns can require skin grafts and long periods of intense rehabilitation and physical therapy.

Physicians currently use several grafting, or implanting, techniques to replace burned skin (Edelson, 2005):

- *Artificial or synthetic skin.* This method poses several drawbacks, including lack of sweat glands, little flexibility, and lack of freedom of movement.
- *Autografting.* Harvests skin from a healthy area on the patient's body and patches it at the site of the burn injury. While this procedure is usually superior to artificial skin, it may not always produce enough healthy skin to cover large injuries.
- *Allografting.* Skin is taken from another source such as a human cadaver or pigskin. These are temporary grafts and must be replaced. A new method, still in the experimental phases uses grafts grown from fetal skin cells or infants. The health of the young skin and its ability to multiply and grow makes it a promising technique. Ethics involved in performing medical procedures on fetuses and infants make this technique challenging.

Although grafting procedures are often successful in children, complications may arise when grafts do not adapt well during children's future growth.

### Psychological Effects of Burns

In several studies, 25% of American and European burn units reported that fewer than 20% of patients received counseling or therapy for psychological issues and even fewer were psychologically assessed after their injuries (Van Loey & Van Son, 2003). Yet, one year after burn injury, another sample of adult survivors reported "worse psychosocial than physical function, regardless of age, gender, burn size, or days hospitalized" (Williams, Doctor, Patterson, & Gibran, 2003).

Following burn injury, the risk for psychological harm increases based on trauma from the burn incident, pain during treatment, and challenges associated with acclimating back into society despite a changed physical appearance. After compiling years of research in this area, Van Loey and Van Son (2003) developed a profile of burn patients most at risk for developing long-term psychological issues:

- Pre-injury psychiatric disorders
- Female gender
- High anxiety related to pain
- High number and severity of initial symptoms during original psychological assessment
- Emotion-focused and avoidant coping styles
- Low social support
- High neuroticism
- Low extraversion

Common psychological issues faced by burn survivors include:

- *Depression.* One year after a burn injury, research demonstrated that somewhere between 13 to 23% of patients experienced depression (Van Loey & Van Son, 2003). Severe depression often occurs because of changed body image and mobility limitations (Latenser & Kowal-Vern, 2002).
- *Post-Traumatic Stress Disorder (PTSD).* PTSD is an anxiety disorder where a person re-experiences the traumatic event and displays avoidant behaviors, emotional numbing, and hyperarousal, resulting in impairment for at least one month. The reported rate of PTSD in burn survivors after one year varies from 15 to 45 percent (Van Loey & Van Son, 2003).
- *Anxiety disorders.* General anxiety disorders appear to be the most common psychological issues for burn survivors after depression, though they have not been the subject of much research after 1990. After one year, the estimated rate of anxiety in burn patients is 13-35% (Van Loey & Van Son, 2003).

Most scientific research has not focused on the psychological issues of childhood burn survivors, though some evidence states that 30% of children met requirements for PTSD six months after their injury (Saxe et al., 2005). More research has investigated abuse/neglect and quality of life in child burn survivors. Approximately 10-20 percent of pediatric burn patients receive injuries through abuse or neglect that could have been prevented

(Latenser & Kowal-Vern, 2002). Typical indicators of abuse or neglect include mental-health issues, substance abuse, and absence of parental control (Hubbuck, 2003).

Only a few decades ago it was rare for children burned over 50% of their bodies to survive. Today, people survive with burns over 80% of their bodies (Van Loey & Van Son, 2003). One long-term study conducted by researchers at the Boston Shriners hospital examined every child who survived a burn of 70 percent or more TBSA between 1969 and 1992. After examining eight quality of life indicators, three were significant enough to improve life quality. They included a healthy and functional family, an early return to pre-burn activities, and consistent follow-up in a specialized burn clinic (Burn Survivors Resource Center, 2002).

It is clear that the physical and psychological recovery needs of burn victims, especially children, are extensive. These children will regularly be absent for long periods during the school year, may experience negative social interaction with peers as a result of their injuries, and often experience long-term physical therapy and rehabilitation. Advances in medicine and therapeutic care have improved the treatment and long-term quality of life of burn survivors. Treatment has shifted towards comprehensive wellness programs, including physical therapy, skin grafting, nutritional needs, and social therapies such as burn education, fire prevention, life skills training, and comprehensive psychotherapy.

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