Burns

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What is a burn?
• A burn is thermal injury to the skin
• Some or all of the different layers of cells in the skin are destroyed by hot liquid, hot solids, or a flame
• Radiation (including ultraviolet), electricity, and chemical damage to the skin are also considered burns

Burn incidence and prevalence
• 126,035 children under 19 were evaluated in emergency departments for burn injuries in 2013
• 1,100 children die each year from fire and burns
  – Nearly half of the children who died were 4 years of age or younger
• As many as 25% of burns are inflicted
• Scald burns are more common among young children
• Tap water burns most often occur in the bathroom
  – Such burns tend to be more severe and cover a larger portion of the body than other scald burns

Classification of Burn Injuries

<table>
<thead>
<tr>
<th>Degree</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Superficial</td>
<td>Superficial layer of the epidermis. Characterized by redness only</td>
</tr>
<tr>
<td>Partial</td>
<td>Extends into the dermis causing blistering and tissue loss</td>
</tr>
<tr>
<td>Full</td>
<td>Entire dermis, appendages, nerves destroyed, no pain</td>
</tr>
<tr>
<td>Fourth</td>
<td>Extends into the muscles, bones and joints</td>
</tr>
</tbody>
</table>

Time required to sustain full-thickness burn

<table>
<thead>
<tr>
<th>Water temp (degrees F)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>10 minutes</td>
</tr>
<tr>
<td>122</td>
<td>5 minutes</td>
</tr>
<tr>
<td>127</td>
<td>1 minute</td>
</tr>
<tr>
<td>130</td>
<td>10 seconds</td>
</tr>
<tr>
<td>135</td>
<td>4 seconds</td>
</tr>
<tr>
<td>140</td>
<td>1 second</td>
</tr>
<tr>
<td>149</td>
<td>0.5 second</td>
</tr>
</tbody>
</table>

Features of abusive burns

- Burns often involve lower trunk, buttocks, perineum, arms, and legs
  - Can appear as “stocking” or “glove” burns
- More likely to have clear demarcation (division) between burns and normal skin, with absence of splash marks
- Uniformly severe burn
- Can see sparing (uninjured skin) of buttocks, soles of feet, flexor creases


Inflicted immersion burn with buttock sparing

This is a similar pattern of injury as seen in the previous photo, with an absence of splash or drip marks, and severe injuries affecting the thighs, perineum, and upper buttocks without any history of injury. An important difference is sparing of the most prominent portion of the buttocks; the sparing is caused by holding the child in hot water with the buttocks against the cooler surface of the tub.

Classic pattern of immersion burn affecting buttocks

Child 2 years old, no history of injury provided. Greater than 24-hour delay in seeking medical attention. Note that the burn is confined to the buttocks with sparing of the gluteal crease (crease between buttocks), and a clear demarcation (dividing line) between injured and non-injured skin. The absence of drip or splash marks, and the symmetrical severity of the burn, help heighten suspicion for abusive trauma.

Accidental immersion burn

Although the distribution of injury is similar to that of the children in the previous two photos, note the lesser (and variable) severity of injury, along with the lack of clear demarcation between injured and uninjured tissue, particularly on the thighs.

Classic immersion injury pattern: Stocking and distribution

Note the symmetric severity of injuries affecting both feet. There is a notable absence of splash or drip marks, and a clear separation of injured from non-injured tissue. There is sparing at the anterior ankles bilaterally, an indication that the child's feet were dorsiflexed (bent upward) at the time of immersion into hot water.

Classic immersion injury pattern: Glove distribution

Note that this child has symmetrically severe bilateral burns to the hands, with a clear demarcation between injured and uninjured tissue. No drip or splash marks are present. The pattern is inconsistent with the provided history of a burn sustained while washing hands.
These burns are more severe at the site of impact (right side of face), and become less severe on the chest, as the liquid cooled. Drip and splash marks are readily apparent on the child’s chest, indicating that he was not wearing a shirt at the time of the incident. This could be an accidental injury, provided that the child has the age and developmental ability to have injured himself.

Patterned burns

Pourover burn

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Lighter burn

This burn has a shape which corresponds to the top of a lighter. Such injuries are caused instantaneously upon contact with the skin, as the temperature of the metal where the flame emerges heats to several hundred degrees. This is a full impression mark, which, as with cigarette burns, can be accidental, depending upon the history of injury. However, multiple burns with full impression marks are diagnostic of abuse.

Cigarette burn

This burn has characteristic features of a cigarette burn, with a measurement of 7 to 8 mm in diameter; circular (or near-circular) shape, and more severe area of central burn. Cigar/cigarillo burns have a similar pattern, but the diameter and exact shape varies. Such burns are caused instantaneously when the lighted cigarette contacts the skin, as the tip has a temperature measuring several hundred degrees. Depending upon the history of injury, one cigarette burn with a full impression mark can be accidental, but multiple burns with full impression marks are diagnostic of abuse.

Burns from heater grate

This child sustained burns on the soles of her feet from being forced to stand on a heater grate for hours. The air coming from the grates of a forced air heating system can reach temperatures well over 100 degrees Fahrenheit. Severe injuries can be caused by forcing a child to stand over a heating grate.

Burn from contact with curling iron

The barrel of a curling iron reaches a temperature of several hundred degrees, and sustains high temperatures for a prolonged period even after being unplugged. A full impression mark of the barrel heightens suspicion of abuse, as with this non-ambulatory child.
Iron burn

Iron burns are often caused by accidental injury in young children, as it is common practice to allow children to play in areas where a heated iron is used, or has recently been unplugged. This burn has an impression of the tip of the iron, with steam holes easily seen.

Burn from contact with hot iron

Although it can be seen that an iron caused the burn seen on the left leg of the child pictured above, based on the triangular shape and steam holes present on the thigh burn, it is difficult to discern how the child may have been positioned at the time of the injury.

Inflicted iron burns

When this child presented for medical care, the father stated that the child was left alone in a room with a hot iron while the father answered the telephone. When father returned to the room, he found that the child had these injuries. The injuries are clearly inconsistent with the stated history; when confronted with this fact, father admitted that he had grown frustrated with the child and placed the iron onto his back multiple times.

Other types of burns

- Radiation burns – commonest is sunburn
- Chemical burns – acid, alkali, peppers, garlic; can cause internal injury with forced ingestion, or external injury with prolonged skin contact
- Electrical burns – combination of heat and electrical forces
- Microwave burns

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