Classification of burns and management

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Burns introduction

Many causes such as:

- dry heat or fire burns normally causing varying areas of deep skin loss
- hot fluids or scalds with burns of a widespread more superficial nature
- flash burns of short duration but intense heat
- electrical burns
- chemical burns
- a large spectrum of radiation burns, from common sunburn to high-energy radiation injuries.
## Classification

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>DEPTH</th>
<th>HISTORY</th>
<th>ETIOLOGY</th>
<th>SENSATION</th>
<th>APPEARANCE</th>
<th>HEALING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>superficial</td>
<td>momentary exposure</td>
<td>sunburn</td>
<td>sharp, uniform pain</td>
<td>blanches red, pink, edematous, soft, flaking, peeling</td>
<td>± 7 days</td>
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<tr>
<td>2nd degree</td>
<td>partial thickness</td>
<td>exposure of limited duration to lower temperature (40-55°C)</td>
<td>scalds, flash burn without contact, weak chemical</td>
<td>dull or hyperactive pain, sensitive to air/temp changes</td>
<td>mottled red, blanches red/pink, BLISTERS, edema, serous exudate, moist</td>
<td>14-21 days</td>
</tr>
<tr>
<td>3rd degree</td>
<td>full thickness</td>
<td>long duration of exposure to high temperature</td>
<td>immersion, flame, electrical, chemical</td>
<td>painless to touch and pinprick, may hurt at deep pressure</td>
<td>no blanching, pale white, tan charred, hard, dry, leathery, hair absent</td>
<td>granulates, requires grafting</td>
</tr>
<tr>
<td>4th degree</td>
<td>underlying structures</td>
<td>prolonged duration of exposure to extreme heat</td>
<td>electrical, flame, chemical</td>
<td>usually painless</td>
<td>charred, 'skeletonized'</td>
<td>amputation fasciectomy</td>
</tr>
</tbody>
</table>
# Classification

<table>
<thead>
<tr>
<th>Major Burns</th>
<th>Moderate Burns</th>
<th>Minor Burns</th>
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<tbody>
<tr>
<td>Burn surface involvement of 25% body surface area. Full-thickness burns 10% body surface area. Deep burns of the head, hands, feet, and perineum. Inhalation injury. Chemical or high-voltage electrical burn.</td>
<td>Burn area of 15-25% body surface area. Superficial partial-thickness burns of the head, hands, feet or perineum. Suspected child abuse. Concomitant trauma. Significant pre-existing disease.</td>
<td>15% body surface area. Nothing involving the head, feet, hands or perineum.</td>
</tr>
</tbody>
</table>
• Superficial burns will heal spontaneously within two weeks
• Deeper burns will form slough requiring sloughectomy or removal with enzymatic debridement and skin graft.
• Difficult to judge the depth of the burn in the early stages
• Re-evaluation every 48 to 72 hours.
• Burn size estimations are derived from the "Rule of Nines". For greatest accuracy and reproducibility, burn size should be determined by plotting the burn wound on Lund and Browder burn diagrams.
The three zones of a burn

• **Zone of coagulation**—Point of maximum damage. Irreversible tissue loss due to coagulation of the constituent proteins.

• **Zone of stasis**—The surrounding zone of stasis is characterised by decreased tissue perfusion but *salvageable*. The main aim of burns resuscitation is to increase tissue perfusion and prevent any damage becoming irreversible. Additional insults—such as prolonged hypotension, infection, or oedema—can convert this zone into an area of complete tissue loss.

• **Zone of hyperaemia**—In this outermost zone tissue perfusion is increased. The tissue here will invariably recover unless there is severe sepsis or prolonged hypoperfusion.

• These three zones of a burn are three dimensional, and loss of tissue in the zone of stasis will lead to the wound deepening as well as widening.
Local Effects Following a Burn

• - loss of water regulation by the skin (direct or by water evaporation)
• - loss of protein
• - loss of electrolytes
• - wound infection
• - vascular thrombosis (deep burns)
• - development of necrotic tissue
• - blisters
• - oedema.
Systemic Effects Following a Burn

- shock - hypovolaemia
- increased blood viscosity
- pulmonary effects
- toxic gases (direct)
- oedema (indirect)
- airway obstruction
- hyperventilation
- increased hormones
  - catecholamine
  - cortisone
  - glucagon
- gastric effects
  - acute gastroduodenal mucosal lesions
  - prolonged gastroduodenal mucosal lesions
  - duodenal ulcer induced by surgery
  - stomach dilatation.
Mechanisms of thermal injury

- **Scalds**—spilling hot drinks or liquids or being exposed to hot bathing water. Cause superficial to superficial dermal burns.
- **Flame**—They are often associated with inhalational injury and other concomitant trauma. Flame burns tend to be deep dermal or full thickness.
- **Contact**—the object touched must either have been extremely hot or the contact was abnormally long. Burns from brief contact with very hot substances are usually due to industrial accidents. Contact burns tend to be deep dermal or full thickness.
EMERGENCY TREATMENT

- Stop the burning or Separate from the burning source.
- ABC
- Intubate if evidence of airway edema (increase over the first 18-24 hours post-injury)
- In all fire victims, administer 100% oxygen to reduce problems from pulmonary dysfunction or carbon monoxide poisoning.
- For thermal burns, immediate application of cold compress (prolonged cooling can precipitate a dangerous hypothermia.)
- Burns of less then 15 % BSA in the conscious and cooperative patient can often be resuscitated orally.
- The patient with more than 15% BSA burn requires IV access.
- An indwelling Foley catheter should be placed to monitor urinary output.
- For electrical burns, remove the offending source with a nonconducting object.
- In chemical injuries, the agent should be diluted with copious irrigation, not immersion.
Fluid Replacement

- Fluid is administered to all patients with burns of 15% or more in adults and 10% or more in children.
- The Parkland formula is the initial choice of fluid regimen with 4 ml/kg/% burn, for the first 24 hours.
- Titrated to maintain urine output between 0.5 and 1.0 ml/kg/h.
- Fluid used is Ringer's lactate or 0.9% saline. It is given as follows:
  - 50% of the total fluid is given in the first 8 hours
  - 50% over the following 16 hours
- The first 24-hour period is counted from the time of injury; that means the calculation must be adjusted accordingly.
- Approximately half of the first day's fluid is given in the next 24 hours and maintenance fluid is added but the intake and output must be monitored carefully. The urinary output must be maintained at minimum of 1 mL/kg/hour.
Escharotomy

- With circumferential burns, if pulses are absent, and fluid resuscitation is adequate, the involved limb should undergo urgent escharotomy.
- In severe chest burns, escharotomy may also be indicated to relieve chest wall restriction and improve ventilation.
- Escharotomies are generally performed at the bedside under IV sedation using electrocautery.
- Midaxial incisions are completed through to bleeding tissue, extending the full length of the eschar to assure adequate release, limbs should be elevated above heart level. Pulses should be monitored for 48 hours.
- Occasionally, escharotomy alone will fail to relieve intra-compartmental pressures, and a formal fasciotomy under general anesthesia is indicated.
- Fasciotomies are always indicated in high voltage electrical injuries and in severe crush injuries.
Local Wound Care

- The wounds may be washed with diluted Savlon solution.
- Blisters may be left intact for 24 hours; it will gradually become dry and then opened, the skin over the blister must not be removed as this serves as a biological cover.
- Topical wound treatment: Betadine and Flamazine. Dressings should be done at least daily. The wounds are normally covered with gauze dressings and bandages.
- Early tangential excision and skin grafting of deep wounds are indicated to cover the wounds as soon as possible.
- Skin grafting: Aim to cover the burned area as soon as possible. Split-thickness skin graft is the first choice but biological dressings like porcine or cadaver skin can be used if operation must be delayed due to systemic illness.
- Future trends: skin cultures will play an important role in extensive burns.
- Tangential excision of already formed granulation tissue can be covered by a split skin graft in large segments or it can be meshed (1:1 to 1:3).
- The *Beta haemolytic streptococcus* is the most dangerous organism and it needs treatment before a skin graft is done - a shiny granulating wound is the clinical manifestation of this type of infection.
Supplementary Mx

• Provision of adequate exogenous calories - 40 kCal/kg/day + 40 kCal% burn/day and 1.4 g protein/kg/day.
• Physiotherapy and early ambulation
• Prevention of septic complications
• Control of external environment - maximum comfort is afforded at 30 °C
Electrical injuries

- “entry” and “exit” points. The tissue between these two points can be damaged by the current.
- Divide electrocution injuries into those caused by low voltage, domestic current and those due to high voltage currents.
- High voltage injuries can be further divided into “true” high tension injuries (voltage is 1000 V or greater), caused by high voltage current passing through the body, and “flash” injuries, caused by tangential exposure to a high voltage current arc where no current actually flows through the body.
- A particular concern after an electrical injury is the need for cardiac monitoring.
Chemical injuries

- Acids cause coagulative necrosis
- Alkali burns produce colliquiative or liquefaction necrosis
- Alkalis tend to penetrate deeper and cause worse burns than acids.
- Removal of all contaminated clothing, and the area thoroughly irrigated.
- Neutralization of alkali with 0.5-5% acetic acid or 5% ammonium chloride.
- Neutralization of acids with sodium bicarbonate.
- Debridement and later skin grafting may be necessary.
Systemic effects may be caused by a few chemicals:

- Hepatic necrosis
  1. phosphorus
  2. tannic acid
- Nephrotoxicity
  1. phosphorus
  2. oxalic acid
  3. hydrofluoric acid.
References

• Abston S, Blakeney P, et al. Total Burn CareResident Orientation Manual. Produced by Galveston Shriners Burn Hospital and The University of Texas Medical Branch Blocker Burn Unit.
• Shehan Hettiaratchy, ABC of burns: Pathophysiology and types of burns