

In the Name of God

Burns



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EPIDEMIOLOGY



- More than **100,000** children each year.
- Fatalities from burns are decreasing, but burns remain a significant cause of **morbidity**.
- **Boys** and age **4 and under** are more likely to sustain a burn injury.
- **Scald** burns are more common in younger children.
- **Thermal** burns secondary to scald or flame are much more common than **electrical or chemical** burns.
- Most deaths and injuries occur in **homes**.

CLASSIFICATION

Burns usually are classified based on four criteria:

- Depth of injury
- % of body surface area involved
- Location of the burn
- Association with other injuries

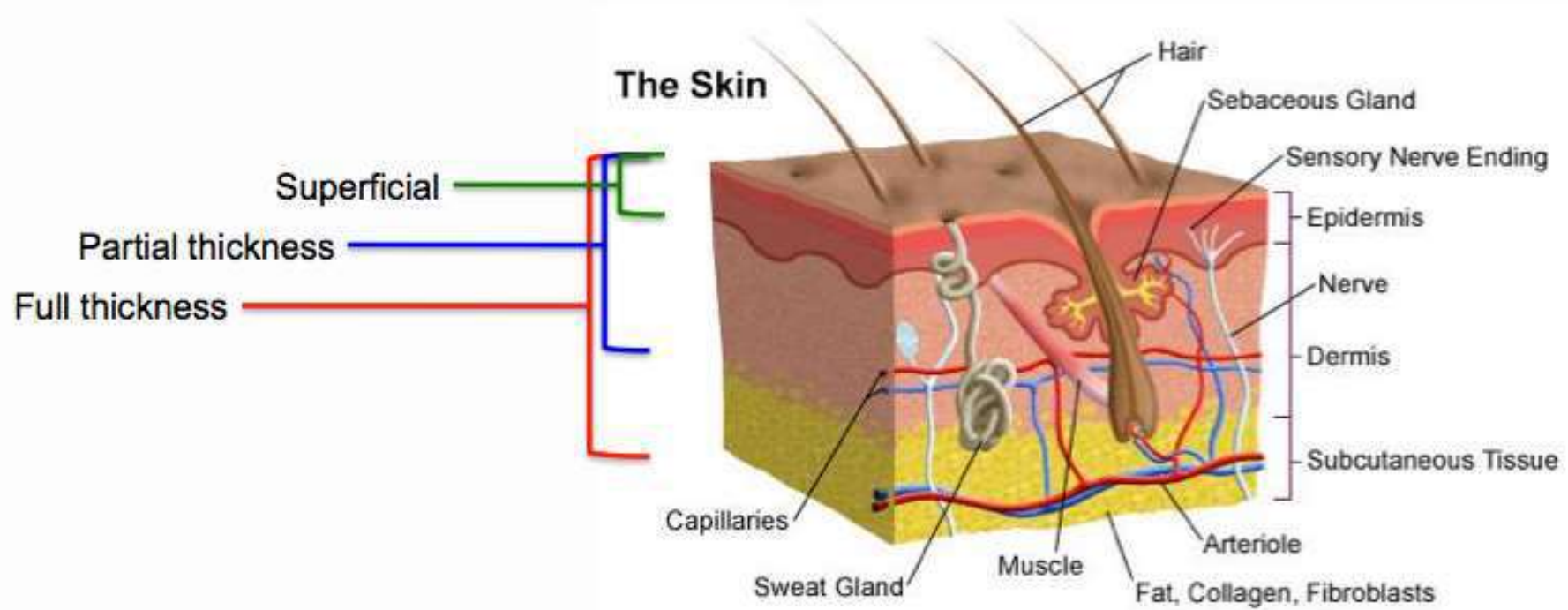
Depth of injury



Depth of injury

- Categories of first-degree, second-degree, and third-degree are commonly used;
- Classification **by depth** (**superficial, superficial partial-thickness, deep partial-thickness, and full thickness**) conveys more information about the structures injured and the likely need for surgical treatment and may **be more clinically useful**.

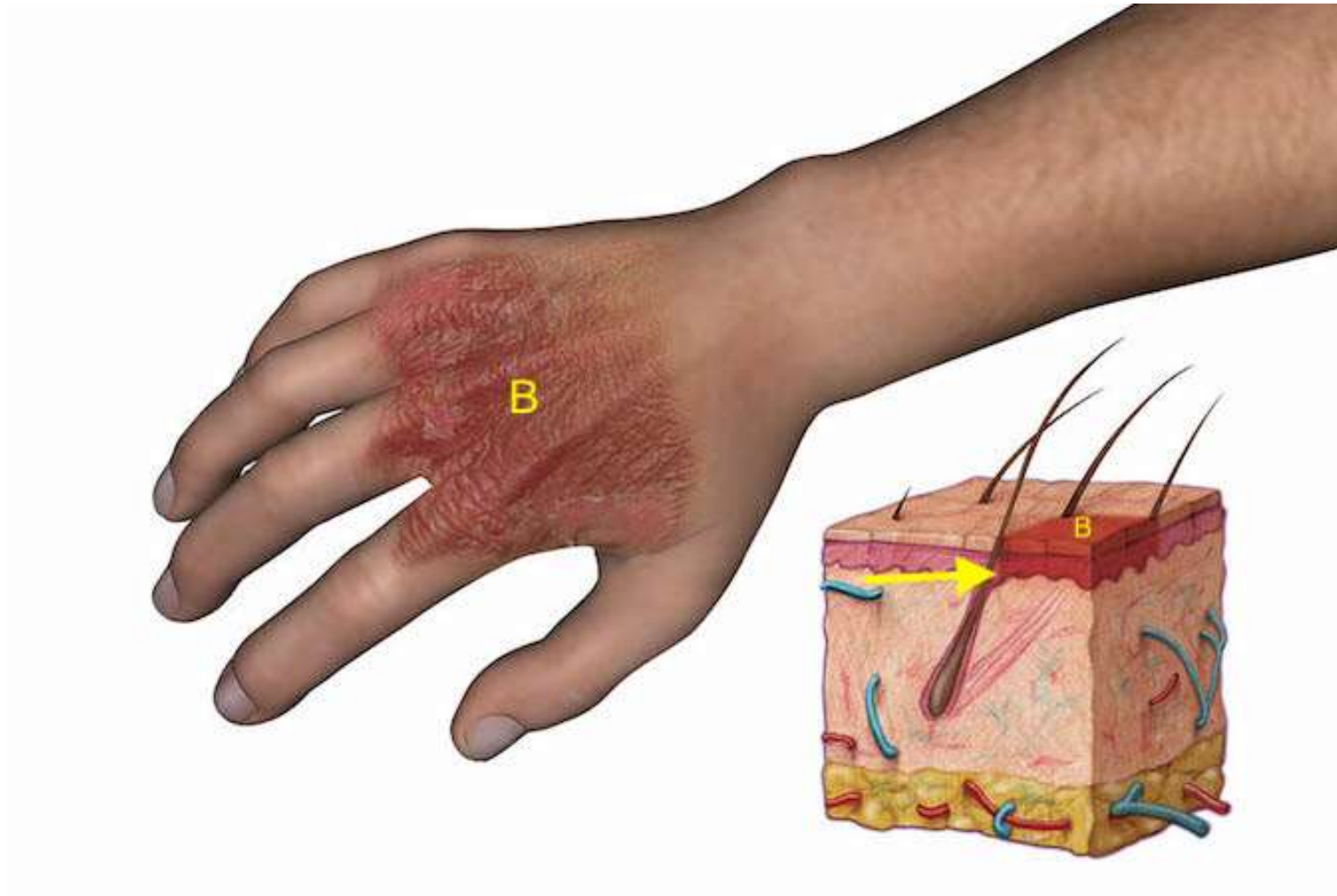
Depth of injury



Depth of injury

- **Superficial (first-degree)** burns are **red, painful, and dry**.
these burns involve injury to the **epidermis only**.
- They are commonly seen with **sun exposure** or **mild scald injuries**,
- They heal in **2-5 days without scarring** and are not included in burn surface area calculations.

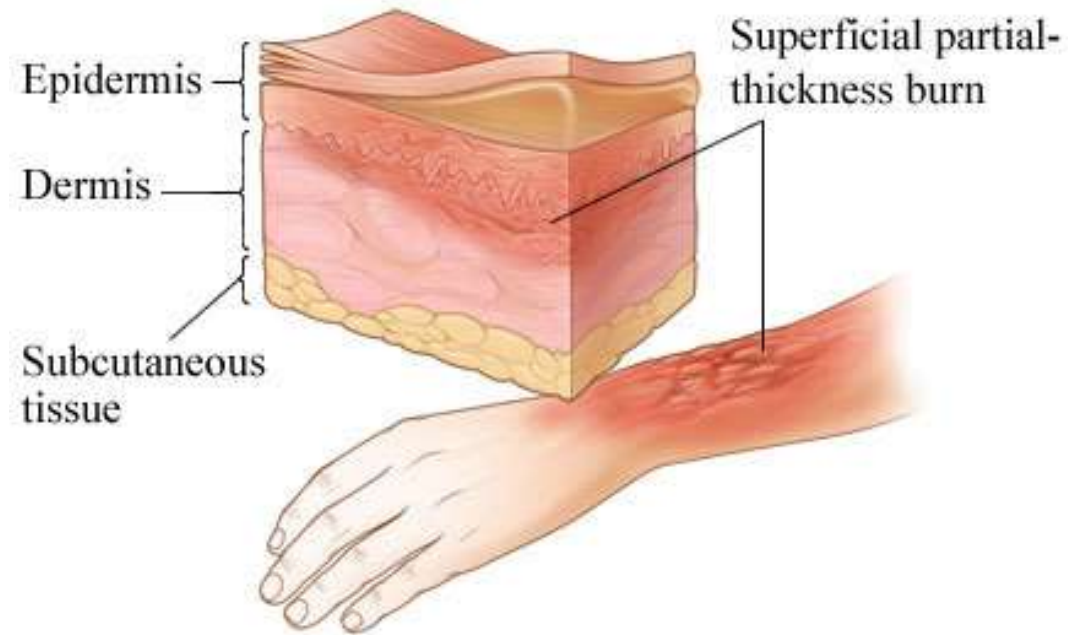
Depth of injury



Depth of injury

- **Superficial partial-thickness** (second-degree) burns involve the **entire epidermis and superficial dermis**.
- Have **fluid-containing blisters**. After debridement, the underlying dermis appears **erythematous and wet, is painful, and blanches under pressure**.
- Healing is dependent on the uninjured dermis and usually occurs within **7–21 days** without the need for skin grafting and without scarring.

Depth of injury

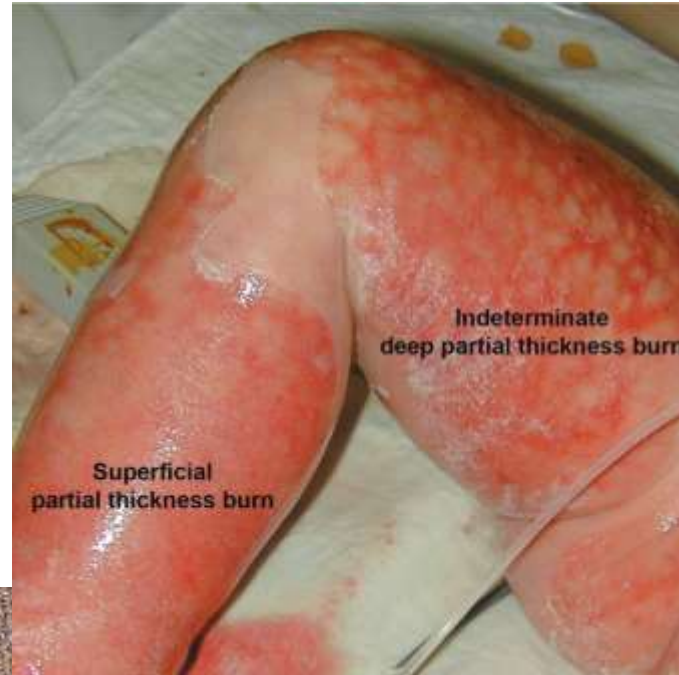


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Depth of injury

- **Deep partial-thickness** (also second-degree) burns involve the **entire epidermis and deeper portions of the dermis**.
- May also have **blistering, but the dermal base is less blanching, mottled pink or white, and less painful** than superficial partial-thickness burns.
- They behave more like full-thickness burns and **often require excision and grafting**.

Depth of injury



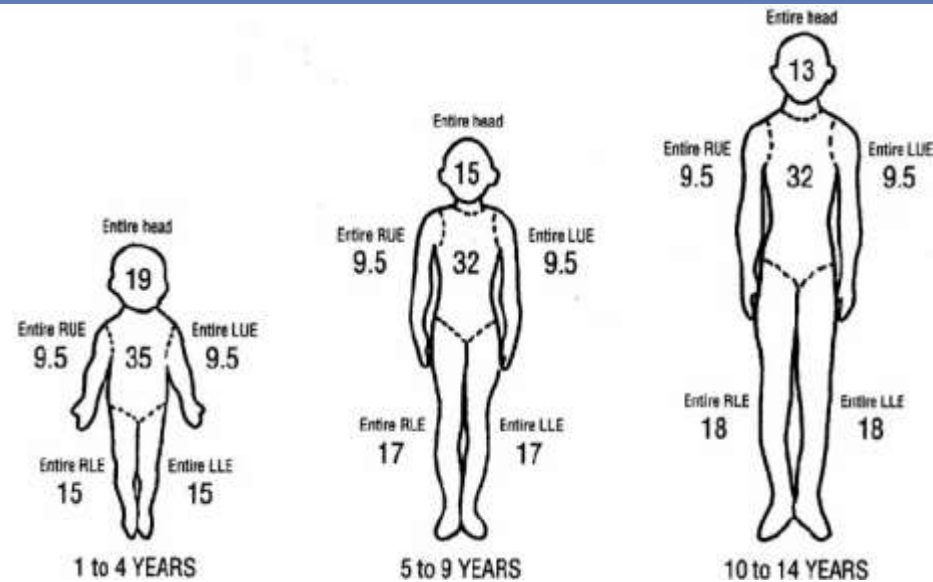
Depth of injury

- **Full-thickness** (third-degree and fourth-degree) burns **involve all skin layers**. Involve **underlying fascia, muscle, or bone**.
- They appear **dry, white, dark red, brown, or black** in color. They **do not blanch** and are usually **insensate**.
- Require **surgical management** and may require **reconstruction in addition to grafting**.

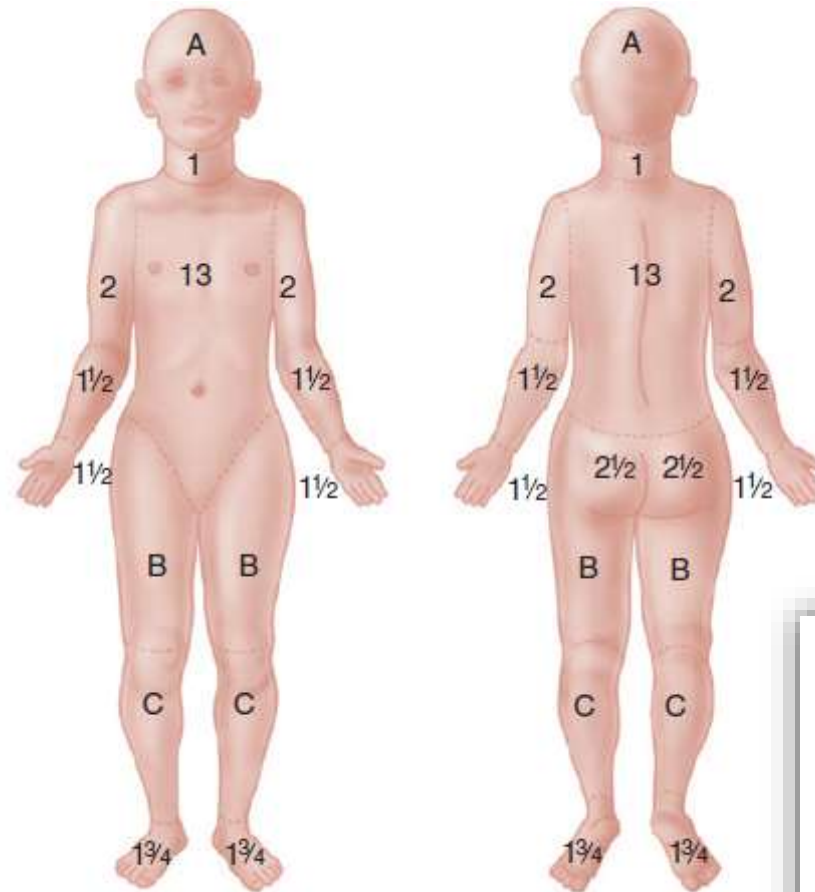
Depth of injury



Surface area in burn



surface area burned in a child



RULES OF NINES

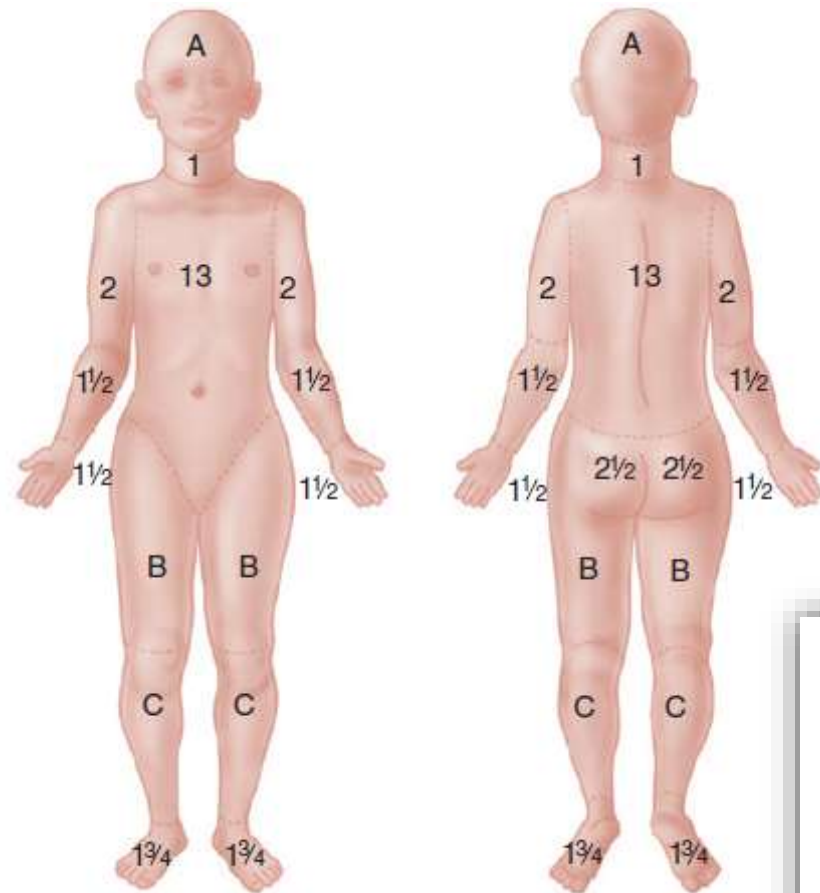
- ▶ Head & Neck = 9%
- ▶ Each upper extremity (Arms) = 9%
- ▶ Each lower extremity (Legs) = 18%
- ▶ Anterior trunk = 18%
- ▶ Posterior trunk = 18%
- ▶ Genitalia (perineum) = 1%

PERCENTAGE OF SURFACE AREA OF HEAD AND LEGS AT VARIOUS AGES

AREA IN DIAGRAM	AGE IN YEARS				
	0	1	5	10	15
A = 1/2 of head	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2
B = 1/2 of one thigh	2 3/4	3 1/4	4	4 1/4	4 1/2
C = 1/2 of one lower leg	2 1/2	2 1/2	2 3/4	3	3 1/4

FIGURE 44.1 This chart of body areas, together with the table inserted in the figure showing the percentage of surface area of head and legs at various ages, can be used to estimate the surface area burned in a child.

surface area burned in a child



PER

ARE

A = 1/2

B = 1/2

C = 1/2

Lund-Browder Chart						
Area	0-1 Years	1-4 Years	5-9 Years	10-14 Years	15 Years	Adult
Head	19	17	13	11	9	7
Neck	2	2	2	2	2	2
Ant. Trunk	13	13	13	13	13	13
Post. Trunk	13	13	13	13	13	13
R. Buttock	2.5	2.5	2.5	2.5	2.5	2.5
L. Buttock	2.5	2.5	2.5	2.5	2.5	2.5
Genitalia	1	1	1	1	1	1
R.U. Arm	4	4	4	4	4	4
L.U. Arm	4	4	4	4	4	4
R.L. Arm	3	3	3	3	3	3
L.L. Arm	3	3	3	3	3	3
R. Hand	2.5	2.5	2.5	2.5	2.5	2.5
L. Hand	2.5	2.5	2.5	2.5	2.5	2.5
R. Thigh	5.5	6.5	8	8.5	9	9.5
L. Thigh	5.5	6.5	8	8.5	9	9.5
R.L. Leg	5	5	5.5	6	6.5	7
L.L. Leg	5	5	5.5	6	6.5	7
R. Foot	3.5	3.5	3.5	3.5	3.5	3.5
L. Foot	3.5	3.5	3.5	3.5	3.5	3.5

FIGURE 44.1 This chart of body areas, together with the surface area of head and legs at various ages, can be used

LOCATION OF THE BURN

- The location of the burn is important in assessing the risk of disability.
- The risk is greatest when the **face, eyes, ears, feet, perineum, or hands** are involved.
- **Inhalation injuries** not only cause **respiratory compromise** but also may result in difficulty in **eating and drinking**.

INHALATION INJURIE

- **Inhalation injuries** should be suspected if:
 - There are facial burns,
 - Singed nasal hairs,
 - Carbonaceous sputum.
 - Hoarseness (supraglottic injury).
- Inhalation injuries may result in **bronchospasm**, **airway inflammation**, and **impaired pulmonary function**.

LABORATORY AND IMAGING STUDIES



EVALUATION

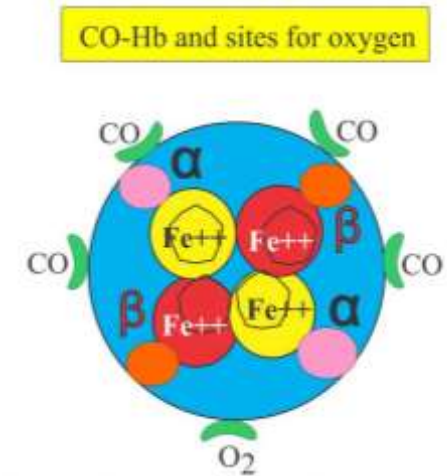
Initial laboratory testing for patients with major burns:

- CBC, type and cross match for blood, coagulation studies (PT, PTT, INR), basic chemistry profile (BS, Na, K, BUN, Cr, Ca, P), ABG, and chest radiograph.



LABORATORY TESTING

- A carboxyhemoglobin assessment should be performed for any **suspected inhalation exposure** (a house or closed-space fire).
- Cyanide levels should be considered in children who sustain smoke inhalation and have altered mental status.



Non Accidental Injury?

- **Unusual patterns of burns** “Glove and stocking” scalds, Artifact shape of burn
- Inconsistency of history and examination
- Delay in presentation
- Signs of other injuries
- Repeated presentation



- Need appropriate evaluation to assess for **non-accidental trauma to the skeleton or central nervous system.**

TREATMENT



PATHOPHYSIOLOGY

Disruption of the 3 key functions of the skin:

1. regulation of **heat loss**,
2. preservation of **body fluids**,
3. and barrier to **infection**.

Essential management points:

- ✓ Stop the burning
- ✓ ABC
- ✓ Determine the percentage area of burn
- ✓ Good IV access and early fluid replacement.

Immediate Priorities

Airway control

Breathing

Circulation



Initial treatment should follow the ABCs of resuscitation

Airway management

- Airway management should include assessment for airway or inhalation injury, with **early intubation** if such an injury is suspected.
- **Smoke** inhalation may be associated with **carbon monoxide** toxicity;
- **100% humidified oxygen** should be given if hypoxia or inhalation is suspected.



PATHOPHYSIOLOGY

Burn injury releases **inflammatory and vasoactive mediators** resulting in:

1. increased capillary permeability,
2. decreased plasma volume,
3. and decreased cardiac output.

The body then becomes **hypermetabolic** with increased resting energy expenditure and protein catabolism(**up to a year** after injury.)

Circulation

Need to administration of intravenous fluids :

- ▶ Children with a significant burn should receive a rapid bolus of **20 mL/kg** of **lactated Ringer** solution.
- ▶ maintenance and ongoing burn-related losses
(**Burn (%) x Weight (kg) x 2-4 CC per day**).
- Calculated from the time of the burn (**Half in first 8 hours**)

Circulation

- ▶ Assess fluid requirements by urine output (0.5 - 2 ml / kg / hr)

Ideally **urine output greater than 1 ml/kg/hr**

- ▶ Controversy exists to administer colloid during fluid resuscitation, but **colloid therapy** may be needed for patients with **extensive burns**.

who should be transferred to a burn center?

- 1) **partial-thickness** burns greater than 10% total body surface area (TBSA);
- 2) **partial and full-thickness** burns involving the **face, hands, feet, genitalia, perineum, or major joints**;
- 3) **full-thickness** burns in any age group;
- 4) electrical burns (including lightning injury);
- 5) chemical burns;
- 6) inhalation injury;
- 7) preexisting medical conditions that could complicate management, prolong recovery, or affect mortality;
- 8) any burn with concomitant trauma;
- 9) burn injury in children admitted to hospitals without qualified personnel or equipment for pediatric care;
- 10) burn injury in patients requiring special social, emotional, or rehabilitative support, including child abuse cases.

PATHOPHYSIOLOGY

Burn injury releases inflammatory and vasoactive mediators resulting in:

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TREATMENT

- Because burn injury produces a hypermetabolic response, children with significant burns require **immediate nutritional support**.
- **Enteral feeds** should be started early unless there is a specific contraindication.
- Children with critical burn injury may require **parenteral nutrition** if unable to tolerate full enteral feeds.
- Consider supplementation of **vitamins and trace elements**.

TREATMENT

- **improve the hypermetabolic state**: pain control, blood glucose control, and the use of medications including anabolic steroids.
- **Wound care** : cleaning and debriding the wound.
- Effective pain control is important to allow for complete debridement.
- **Topical agents and dressings** to control bacterial colonization, decrease evaporative losses, and aid in pain control.
- For full-thickness burns, **skin autografting** and skin substitutes are required for eventual closure.

COMPLICATIONS



COMPLICATIONS

TABLE 44.1 Complications of Burns	
PROBLEM	TREATMENT
Sepsis	Monitor for infection, avoid prophylactic antibiotics
Hypovolemia	Fluid replacement
Hypothermia	Adjust ambient temperature: dry blankets in field
Laryngeal edema	Endotracheal intubation, tracheostomy
Carbon monoxide poisoning	100% oxygen, hyperbaric oxygen
Cyanide poisoning	100% O ₂ plus amyl nitrate, sodium nitrate, and sodium thiosulfate
Cardiac dysfunction	Inotropic agents, diuretics
Gastric ulcers	H ₂ -receptor antagonist, antacids
Compartment syndrome	Escharotomy incision
Contractures	Physical therapy

COMPLICATIONS

TABLE 44.1 Complications of Burns	
PROBLEM	TREATMENT
Hypermetabolic state	Enteral and parenteral nutritional support, pain control, glucose control, consider β blockers and anabolic steroids
Renal failure	Supportive care, dialysis
Transient antidiuresis	Expectant management
Anemia	Transfusions as indicated
Psychological trauma	Psychological rehabilitation
Pulmonary infiltrates	PEEP, ventilation, oxygen
Pulmonary edema	Avoid overhydration, give diuretics
Pneumonia	Antibiotics
Bronchospasm	β -Agonist aerosols

PEEP, Positive end-expiratory pressure.

PROGNOSIS & PREVENTION



PROGNOSIS

- Most children who sustain burns recover without significant disability,
- **Physical scarring** and **emotional impact** of disfiguring burns are long-term consequences of burn injuries.



PREVENTION

Most burns occur in the **home**.

1. Using smoke and fire **alarms**,
2. having identifiable **escape routes** and a **fire extinguisher**,
3. **reducing hot water temperature** to 49°C (120°F). Immersion full-thickness burns develop after 1 second at 70°C ,after 5 seconds at 60°C ,after 30 seconds at 54.5°C ,and after 10 minutes at 49°C .

TAKE HOME MESSAGE

- **Location of burn** is important.
- **Inhalation injuries** may result in bronchospasm, airway inflammation, and impaired pulmonary function.
- Initial treatment should follow the **ABCs** of resuscitation .
- ▶ maintenance and ongoing burn-related losses (**Burn (%) x Weight (kg) x 2-4 CC per day**). (**Half in first 8 hours**).
- ▶ Children with a significant burn should receive a rapid bolus of **20 mL/kg** of **lactated Ringer** solution.
- who should be **transferred to a burn center**?
- burn injury produces a **hypermetabolic state**.
- **Non Accidental Injury**?
- Most burns occur in the **home**.

ANY
QUESTIONS?

