



BURNS ASSESSMENT & RESUSCITATION

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Demographic analysis shows four high-risk groups for severe burn injuries

- the very young
- the very old
- the very unlucky
- The very careless

Classification by etiology:

- Thermal burns:

1. Scald burns:

- 60 degrees → 3 sec → deep partial or full thickness burns
- 69 degrees → 1 sec → " " " " " "
- Boiling water → deep burns
- Oil → deep dermal burns
- If burn is in contact with clothes → deeper burn

2. Flame burns:

- 2nd most common type
- If cloths have been involved → full thickness burns

3. Flash burns:

Caused by:

- explosions of natural gas, gasoline, and other flammable liquids
- Electrical flash where electrical current does not pass through the body.



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Contact burns:

- Hot metals, plastics, coals,
- industrial injuries
- +/- crush injury
- Usually deep dermal or full thickness burns

Pathophysiology:

I. Systemic :

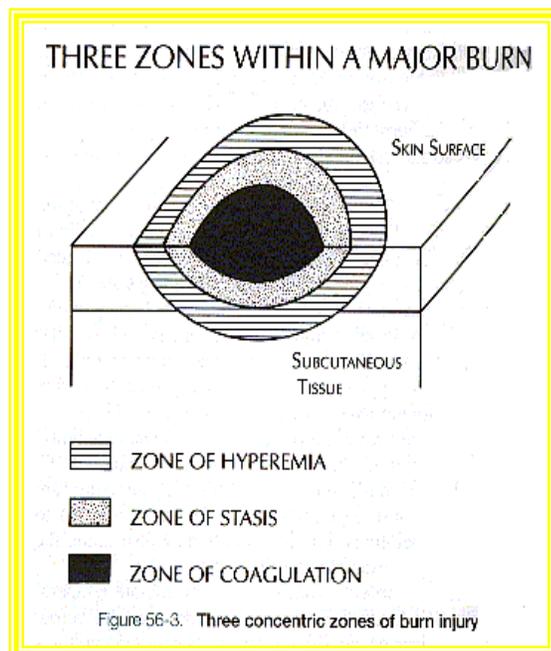
a) hyperpermeability of capillaries

1. neural
2. humoral

b) heat-induced denaturing of collagen fibers

c) Immune response to burns

2. Local effects:





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Initial Triage & Management:

- **General Hx:** Pre-existing medical conditions
 - medications taken
 - allergies
- **History of the circumstances of the injury:**
 - time of burn
 - place
 - burning agent
 - contact time
 - cloths
 - any treatment used
 - associated injuries

History suggestive of inhalation injury:

- patient who was burned in a closed space
- who inhaled smoke
- loss of consciousness
- history of industrial injuries
- Has:
 - Strider and change in voice
 - Erythema and carbonaceous material in the back of the throat or sputum.
 - singed nasal hairs
 - Facial burn



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Examination:

a) Systemic:

A & B:

- airway patency
- signs of inhalation injury and respiratory embarrassment

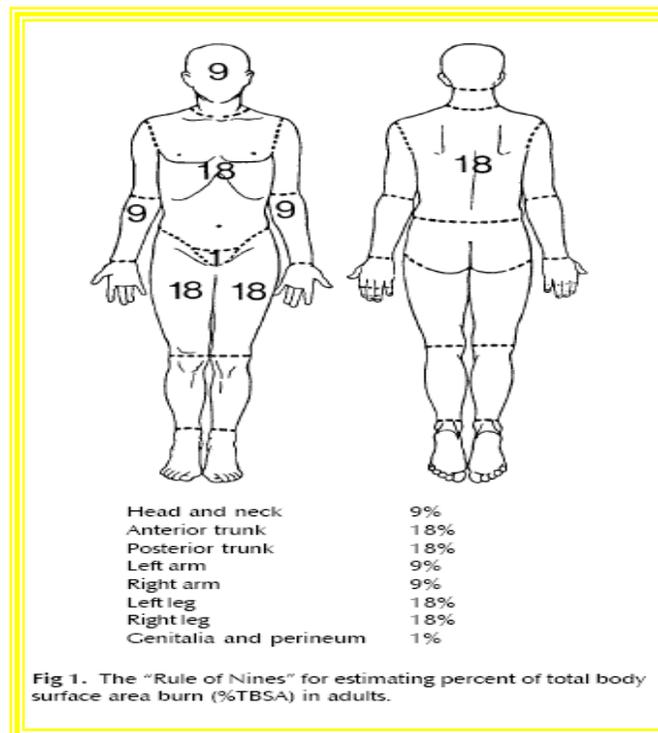
C:

- Monitor blood pressure, pulse and signs of peripheral vascular insufficiency in the limbs
- In cases of circumferential deep partial thickness or full thickness burns to suspect compartment syndrome

b) Local:

Estimation of TBSA:

Rule of nines:





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The Lund and Browder charts:

Age: _____
Sex: _____
Weight: _____

Area	Birth-1 yr	1-4 yr	5-9 yr	10-14 yr	15 yr	Adult	Partial thickness 2°	Full thickness 3°	Total
Head	19	17	13	11	9	7			
Neck	2	2	2	2	2	2			
Anterior trunk	13	13	13	13	13	13			
Posterior trunk	13	13	13	13	13	13			
Right buttock	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2			
Left buttock	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2			
Genitalia	1	1	1	1	1	1			
Right upper arm	4	4	4	4	4	4			
Left upper arm	4	4	4	4	4	4			
Right lower arm	3	3	3	3	3	3			
Left lower arm	3	3	3	3	3	3			
Right hand	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2			
Left hand	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2			
Right thigh	5 1/2	6 1/2	8	8 1/2	9	9 1/2			
Left thigh	5 1/2	6 1/2	8	8 1/2	9	9 1/2			
Right leg	5	5	5 1/2	6	6 1/2	7			
Left leg	5	5	5 1/2	6	6 1/2	8			
Right foot	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2			
Left foot	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2			
Total									



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Special Conditions:

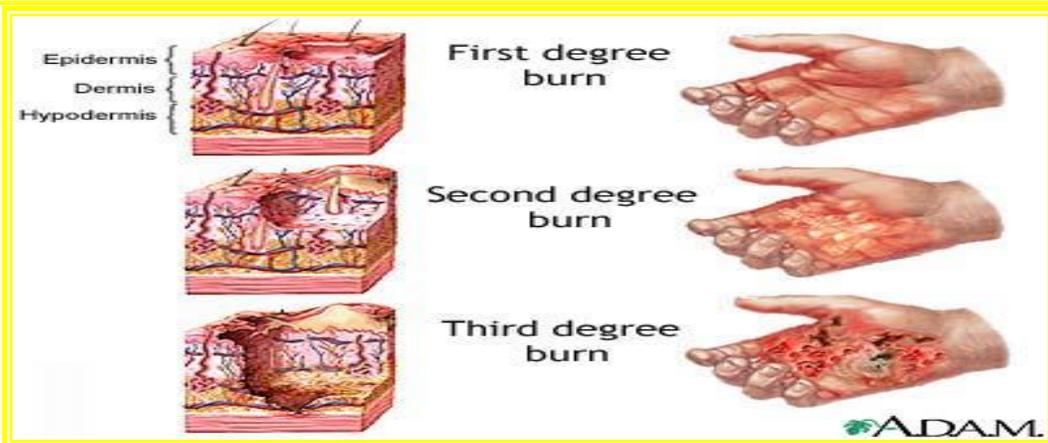
-Circumferential burns:

-Ophthalmic burns:

Burn depth:

TABLE 4. *Burn depth categories in the United States*

Burn degree	Cause	Surface appearance	Color	Pain level
First (superficial)	Flash flame, ultraviolet (sunburn)	Dry, no blisters, no or minimal edema	Erythematous	Painful
Second (partial thickness)	Contact with hot liquids or solids, flash flame to clothing, direct flame, chemical, ultraviolet	Moist blebs, blisters	Mottled white to pink, cherry red	Very painful
Third (full thickness)	Contact with hot liquids or solids, flame, chemical, electrical	Dry with leathery eschar until debridement; charred vessels visible under eschar	Mixed white, waxy, pearly, dark, khaki, mahogany, charred	Little or no pain, hair pulls out easily
Fourth (involves underlying structure)	Prolonged contact with flame, electrical	Same as with third degree, possibly with exposed bone, muscle, or tendon	Same as third degree	Same as third degree





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Investigations:

- CBC
- U & E
- Urine analysis for myoglobinuria
- ABG (for hypoxemia)
- Carboxyhemoglobin levels (>15%)
- X-ray of C-spine, CXR , Abs X-ray to rule out associated injuries

Referral criteria :

According to the American Burn Association:

- 2nd and 3rd degree burns >10% TBSA patients (extreme ages)
- 2nd and 3rd degree burns >20% TBSA in other Age groups
- 3rd degree burns >5% TBSA in any age group
- 2nd and 3rd degree burns involving the face, Hands, feet, genitalia, perineum, or major joints.

The American Burn Association:

- Electric burns, including lightning injury
- Chemical burns with serious threat of functional or cosmetic impairment
- Inhalation injuries
- Lesser burns in patients with preexisting medical Problems that could complicate management
- combined mechanical and thermal injury



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Management:

1. AIRWAY & BREATHING:

Indications for Intubation:

- unconscious ptn
- Ptns in respiratory distress
- Ptns who have suffered severe burns
- Ptns who are hemodynamically unstable despite fluid resuscitation
- where there is any question of an inhalation injury
- Upper airway burn.

2. Circulation:

- Fluid management
- When do we start IVF?
 - Adults >20% TBSA
 - Children >10-15% TBSA
- The goal of IVF:
 - restore and maintain adequate tissue perfusion and oxygenation
 - avoid organ ischemia
 - preserve heat-injured but viable soft tissue
 - Minimize exogenous contribution to edema.
- All formulas for resuscitation are guidelines only



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Monitoring:

- Important part of resuscitation.
 - HR:
 - BP:
 - Urine Output:
 - INVASIVE MONITORING: (CVP & PULOMARY ARTREY CATH)
 - ABG:
 - HEMATOCRIT:

Formula	Fluid in First 24	Crystalloid in Second 24 h	Colloid in Second 24 h
Parkland	RL at 4 mL/kg/ % burn	20-60% estimated plasma volume	Titrated to urinary output of 30 mL/h
Evans (Yowler, 2000)	NS at 1 mL/kg/ % burn, 2000 mL D5W*, and colloid at 1 mL/kg/ %burn	50% of first 24-hour volume plus 2000 mL D5W	50% of first 24-hour volume
Slater (Yowler, 2000)	RL at 2 L/24 h plus fresh frozen plasma at 75 mL/kg/24 h		
Brooke (Yowler, 2000)	RL at 1.5 mL/kg perpercentage burn, colloid at 0.5 mL/kg/ % burn, and 2000 mL D5W	50% of first 24-hour volume plus 2000 mL D5W	50% of first 24-hour volume
Modified Brooke	RL at 2 mL/kg/ % burn		
MetroHealth (Cleveland)	RL solution with 50 mEq NaHCO3 per liter at 4 mL/kg/ % burn	Half NS titrated to urine output	1 U FFP for each liter of ½ NS used+ D5W as needed for hypoglycemia
Monafo hypertonic Demling	250 mEq/L saline titrated to urine output at 30 mL/h, dextran 40 in NS at 2 mL/kg/h for 8 hours, RL titrated to urine output at 30 mL/h, and fresh frozen plasma 0.5 mL/h for 18 hours beginning 8 hours postburn	One-third NS titrated to urine output	

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Colloids:

Albumin:

- is the most oncologically active of the protein solutions
 - ½ of its volume remains intravascular, in comparison to 20-30% of crystalloid solutions.
 - Administration:
 - 30-50% burn → 5% albumin IV @ 0.3ml/kg/% burn
 - 50-70% burn → 5% albumin IV @ 0.4ml/kg/% burn
 - >70 % burn → 5% albumin IV @ 0.5ml/kg/% burn
 - The patients who benefit the most from lower-volume resuscitations aided by colloid are:
 - Those with larger burns (>40%)
 - those with preexisting heart disease
 - geriatric patients
 - those with associated inhalation injuries
- Resuscitation in children
- Have a higher fluid requirement due to the increased body surface area
 - Parkland's formula + maintenance fluid
 - (What type of maintenance fluid?)
 - Higher incidence of hypoglycemia due to limited glycogen reserve



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Eschcarotomy:



Fig2. Preferred sites for escharotomy. (Reprinted with permission from Moylan JA Jr, Inge WW Jr, Pruitt BA Jr: Circulatory changes following circumferential extremity burns evaluated by the ultrasonic flowmeter. An analysis of 60 thermally injured limbs. *J Trauma* 11:763, 1971.)



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Initial wound assessment and care:

Pain control:

- Morphine.
- patient-controlled analgesia:
- Clinical psychologists can be of great assistance in helping the patient develop non pharmacologic methods of pain control.

Nutrition:

PE prevention:

- Routine prophylactic heparinization is not justified in burn patients
- preventive efforts should be directed at patients with classical risk factors for pulmonary emboli:
 - history of prior thromboembolic disease
 - obesity
 - Burns of the lower extremities.

Gastric Decompression:

- NGT should be inserted in large burns to prevent:
 - Gastric ulceration
 - Aspiration

Tetanus:

- Immunization status not known → booster
- Previous immunization 10 yrs ago → booster
- Previous immunization 5 yrs ago → nothing



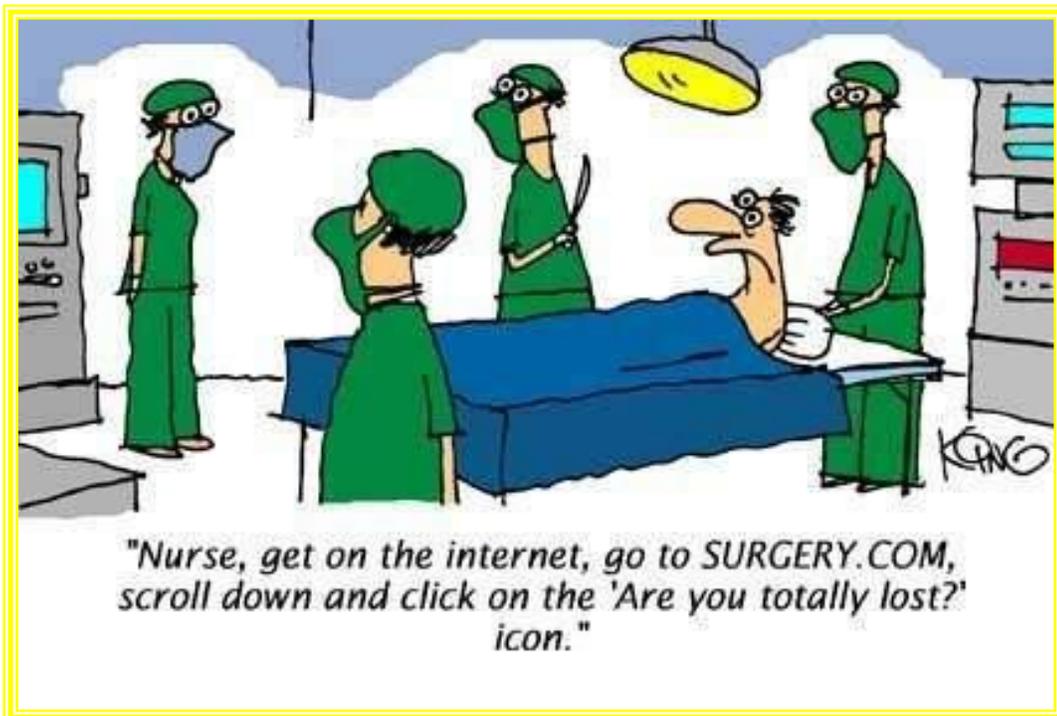
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Management of burn injuries in pregnancy:

1. Early pregnancy test for all females ptn of child bearing age.
2. Prompt and aggressive fluid resuscitation.
3. Early supplemental oxygen and low threshold for mechanical ventilatory support.
4. Early delivery if the fetus is in the third trimester.
5. High suspicion for venous thrombosis and sepsis, with early and aggressive treatment.



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