

# PLASTIC & RECONSTRUCTIVE SURGERY

LEC 1

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اختصاص الجراحة التقيومية

## BURN

**Burn means thermal injury.** It is a coagulative necrosis of the skin and underlying tissues to a variable depths due to wide range of temperature ranging from the lowest (frostbite) to the highest( electrical injury).

### Risk factors :

1.Children under 5 years old. 2. alcoholism, 3. senility, 4. psychiatric disorders, 5. neurological disease such as epilepsy. 6. Males account for two-thirds , 7. Careless

### Classification of burn

#### 1-physical:

**Scald:** the commonest burn by application of hot fluids(boiling water, milk, oil) The time of exposure, and the temperature of the fluids, and fluid viscosity is important to determined the depth of burn.

Time	Temperature (°F)
1 second	158
2 seconds	150
10 seconds	140
30 seconds	130
1 minute	127
10 minutes	120

**Flame burn:** most next common burn, by house fire or spilled petrol on the skin, deep dermal or full thickness.often associated with inhalational injury

**flash burn:** results from gas explosion that cause heat exposure for a very brief time. Tissue damaged is usually partial thickness.

**Contact with hot object** → deep dermal or full thickness burns. Common in an unconscious or epileptic patients

**Electrical burn:** passage of electrical current cause tissue injury. A common phenomenon is progressive loss of viable tissues.muscle tissue is vulnerable

**Friction burn:** due to combination of heat and abrasion.

**Ionizing radiation:** tissues necrosis may not develop immediately..

**Cold injury(frost bite):**

**2-chemical burn:** caused by Acid and Alkali. Alkali tend to penetrate deeper and cause worse burns than acids.

## Pathophysiology of burn:

### Local effect:

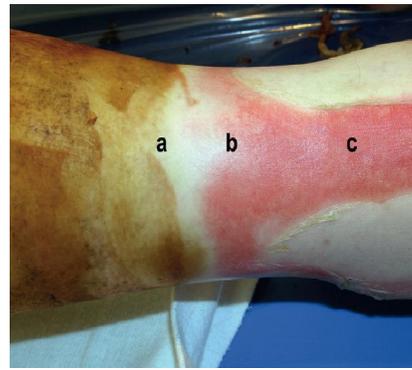
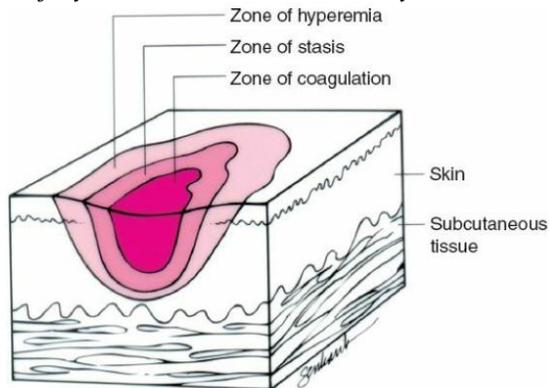
**The burn area subdivided into 3 zones(Jackson zones):**

**1-Zone of coagulation:** which most affected area by heat,. In this zone there is irreversible tissue loss due to coagulation of the proteins and there is no blood flow.

**2-Zone of stasis:** Surrounds the zone of coagulation and is characterized by decreased tissue perfusion. The tissue in this zone is potentially salvageable. **The main aim of burns resuscitation is to increase tissue perfusion here and prevent any irreversible damage.**

Additional insults—such as prolonged hypotension, infection, or oedema—can convert this zone into an area of complete tissue loss.

**3-Zone of hyperemia:** outmost zone, which entirely viable and tissue perfusion is increased. It sustained minimal injury. This zone contributes to systemic consequence seen in major burn.



### Systemic:

**Systemic response to the release of cytokines and other inflammatory mediators at the site of injury once the burn reaches 20-25% of total body surface area:**

- ❑ **Cardiovascular changes**—Capillary permeability is increased→ loss of intravascular proteins and fluids into the interstitial compartment→edema.  
  
Peripheral and splanchnic vasoconstriction occurs. Myocardial contractility is decreased ,possibly due to release of tumour necrosis factor . These changes, coupled with fluid loss from the burn wound, result in systemic **hypotension and end organ hypoperfusion.**
- ❑ **Respiratory changes**—Inflammatory mediators cause bronchoconstriction , and in severe burns adult respiratory distress syndrome can occur.
- ❑ **Metabolic changes**—The basal metabolic rate increases up to three times its original rate. This, coupled with splanchnic hypoperfusion, necessitates early and aggressive enteral feeding to decrease catabolism and maintain gut integrity.
- ❑ **Immunological changes**—Non-specific down regulation of the immune response occurs, affecting both cell mediated and humoral pathways.
- ❑ **Hematologic**—There is immediate red blood cell destruction in direct proportion to the extent of the burn, particularly third-degree burns. Endothelial injury may lead to release of thromboplastins and to collagen exposure; the latter then initiates platelet adhesion, aggregation, and contact activation of factor XII. Severe

full-thickness burns induce consumption of coagulation factors at the burn site, which contributes to the (DIC).

- ❑ **Gastrointestinal**—Ileus is universal in patients with burns of more than 25% total body surface area (TBSA). Gastric and duodenal mucosal damage, secondary to focal ischemia, can be observed as early as 3–5 hr postburn. If the mucosa is unprotected, the early erosions may progress to frank ulceration.
- ❑ **Endocrine**—In the early postburn period, a *catabolic endocrine* pattern develops that is characterized by elevated glucagon, cortisol, and catecholamine levels with depressed insulin and triiodothyronine levels→ negative nitrogen balance. Their magnitude correlates with the size of the burn area

### ***First Aid***

- 1-Stop the burning process by removal the patient to safe place.
- 2-Immediate cool the burn surface with cold water, hypothermia must be avoided.
- 3-Wrap the patient in clean linen and then transfer to hospital

### ***Outpatient Management***

1-Open large blisters(the small one can be left) and wash with normal saline or sterilized water and soap.

2-Pain killers.

3-Topical antimicrobial agents (Silver sulfadiazine (Flamazine),Mafenide acetate.

5-Dressing→ ***Ideally, a burn dressing should be absorbent, non-adherent, and should act as a barrier to prevent colonization of the wound by pathogenic bacteria***

## ***MANAGEMENT OF MAJOR BURN***

- ❑ **Indications for hospital admission** (BURN CENTER REFERRAL CRITERIA):
  1. Second and third degree burns >10% body surface area (BSA) in patients <10 or >50 years old
  2. Second and third degree burns >20% BSA in other groups.
  3. Second and third degree burns that involve face, hands, feet, genitalia, perineum, and major join.
  4. Third degree burns >5% BSA in any age group.
  5. Electrical burns, including lightening injury.
  6. Chemical burns with serious threat of functional or cosmetic impairment.
  7. Inhalation injury with burn injury.
  8. Circumferential burns with burn injury
  9. Burn injury in patients with pre-existing medical disorders
  10. Any burn patient with concomitant trauma (for example fractures)

□ Initial care: (ABCDEF)

**A=airway:**

- As with all trauma patients, the first priority is maintenance of airway with cervical spine protection.
- Endotracheal intubations is indicated if patient (**Semicomatose, Deep burn to face and neck and any suspicion of inhalational injury**). Intubaton should done early ,since with development of burn edema (8-12 hours)the intubation will be difficult.
  - When intubation is difficult, tracheostomy should be done.

**B=breathing:**

- Give 100% O2 if there is suspicion of inhalational injury
- Assess movement of chest wall to exclude restricted movement due to eschar

**C=circulation:**

- Assess peripheral perfusion
- ECG monitoring in case of electrical injury
- Stop bleeding if associated with vascular injury
- **Initially should established good I.V line, if not possible → Venous cutdown**

Two peripheral IV lines are usually sufficient for patients with less than 30% burns. patients with larger burns or significant inhalation injury will require central line placement. Both peripheral and central lines can be placed through burned tissue when required.

**D=disability:**

- Assess neurological status
- Note any gross deformity (fracture)

**E=exposure:**

- **Expose all body to exclude other trauma and to evaluate the burn wound.**
- **Avoid hypothermia**

Evaluation of burn:

The extent and depth of burn wounds are established shortly following admission:

**a) Depth:**

1. **by physical examination it categorized into 4 type:**

Burn degree(Depth)	Skin layer involved	Clinical appearance	Pain Sensation	Capillary Refill
1 <sup>st</sup> degree(Superficial)	Epidermis only	Erythematous	Painful	+ve brisk return
2 <sup>nd</sup> degree(partial thickness)	Superficial 2 <sup>nd</sup> degree (Superficial partial)	Pink to red,Moist,Blisters.	Very Painful	+ve Slow return
	Deep 2 <sup>nd</sup> degree (Deep partial)	Mottled pink ,cherry red & white,Dry,Blisters(larger ).	Dull	-ve
3 <sup>rd</sup> degree (Full thickness)	Fullthickness Skin(Epidermis+Dermis)	Mixed white,dark and khaki colours.The skin is dry, leathery or waxy.Thrombosed v vessels may be seen under the eschar.	Insensate	-ve
4 <sup>th</sup> degree	Fullthickness skin + Subcutaneous tissues (Fat, Muscle,Tendon, Bone ....etc).	As 3 <sup>rd</sup> degree but with the involvement and exposure of subcutaneous structures.	Insensate	-ve

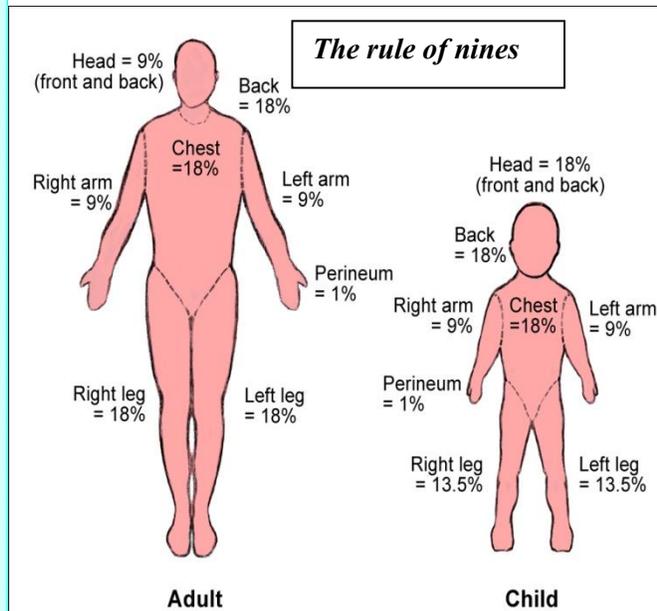
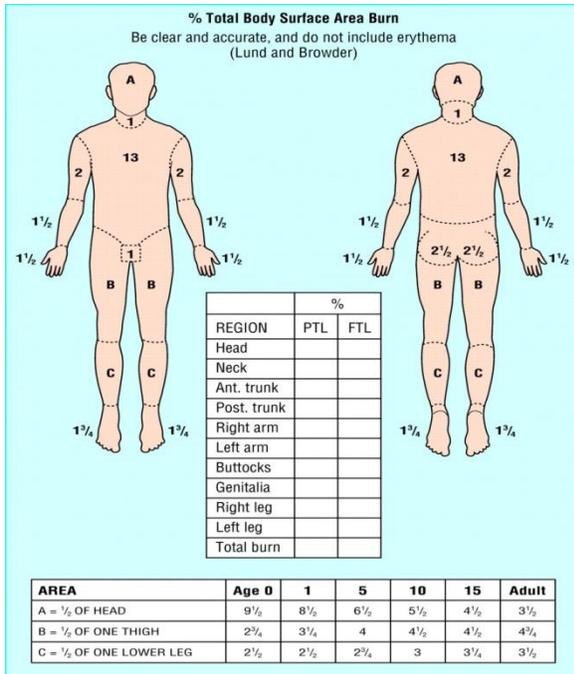
2. **examination for dead cell (biopsy, vital dyes).**
3. **change in blood flow (Doppler study, fluorescin, thermographic essay ).**
4. **U/S &MRI.**

**b) Assessment of burn extent:**

There are several techniques used to calculate the total body surface area (TBSA) burned:

1. **The rule of nines:** is the best-known method of estimating burn extent.
2. **Lund and Browder charts:** are a more accurate method of assessing burn extent. They provide an age-based diagram to assist in more precisely calculating the burn size.
3. **The patient's hand:** The patient's hand represents approximately 1% TBSA.

**When calculating TBSA, only include those areas of partial and full-thickness dermal injury. Superficial burns involving the epidermis only are not included in the calculation.**



**F=Fluids:**

Fluid resuscitation:

**Indicated in pt with burn more than 15-20% TBSA in adult and >10% in children.**

- **Initially should established good I.V line, if not possible → Venous cutdown**
- **Foley's catheter should be used to assess urine output.**

**DAY 1:(Hr 0-24)**

**Parkland formula:** most commonly used formula in first 24 hours post burn.

**4cc/kg/%burn=total volume for 24 hr**

**Give 1/2 of total volume in 1<sup>st</sup> 8hr (from time of injury)**

**Give 1/2 of total volume in 2<sup>nd</sup> 16 hr**

**Use lactated ringer solution.**

*The starting point for resuscitation is the time of injury, NOT the time of admission and the burn area of the first degree should NOT be included.*

The formula is only a guideline. Fluid administration should be titrated to urine output of 30cc/hr for adults and 1 cc/kg/hr for children.

Children who weigh less than 15 kg should also receive a maintenance IV rate with dextrose-containing solution since young children do not have adequate glycogen stores:

4 ml/kg for first 10 kg of body weight plus  
2 ml/kg for second 10 kg of body weight plus  
1 ml/kg for > 20 kg of body weight.

Colloid is typically not used until 12 to 24 hours following bum injury when the capillary leak has started to seal.

### **DAY 2:(Hr 25-48)**

**Change lactated ringer to D5W and adjust based on urine output.**

**Begin colloid infusion**

### **DAY 3:(Hr 49+)**

**Change to maintenance IV or begin PO intake and/or enteral feeding.**

**For patients with burns >40% to 50% or in the presence of significant inhalation injury or previously existing cardiorespiratory disease, consider beginning colloid earlier (hour 8-24) and continuing through day 2.**

**Types of colloid:**

- **Heat-fixed proteins (Plasmanate )**
- **Albumin**
- **Fresh-frozen plasma**
- **Non protien colloid e.g Dextrans**

**Blood—for full thickness burns of more than 10% TBSA, the whole blood requirement is estimated at 1% of the patient's normal blood volume for each 1% deep burn.**

### **Escharotomy:**

Circumferential burns and leathery eschar of extremity can cause compartment syndrome and/or distal ischemia and necrosis. Circumferential eschar of the chest wall compromises thoracic cage excursion and, thus, ventilation of the patient.

Indicated for :

1. Deep 2<sup>nd</sup> and 3<sup>rd</sup> degree circumferential burns of the extremity .
2. Deep 2<sup>nd</sup> and 3<sup>rd</sup> degree circumferential burns of the chest wall .

### **Pain control:**

Burn patients typically have two types of pain:

**Background pain** :Best treated with longer acting agents :

**Morphine IV**, (not in neonates), 0.1 mg/kg/dose ,4-6 hourly

**Pethidine IV**, 1-1.5 mg/kg/dose , 4-6 hourly.. Nonsteroidal agents should be avoided.

**Procedural pain** occurs during daily wound care and therapy. shorter acting agents are probably best. use of short-acting **benzodiazepines** is favorable.

**Routine tetanus prophylaxis is employed.**

**There is no role for prophylactic systemic antibiotic therapy.** Give antibiotics when there are features of infections.

- ❑ **Put NG tube and prescribe antacids** :When the burn surface area is 25% or more of deep burn, the patient is liable to develop paralytic ileus and stress gastro-dudenal erosions or ulcers→ put NG tube and prescribe antacids.
- ❑ **Frequent checking of PCV, S.electrolytes, and renal function tests.**

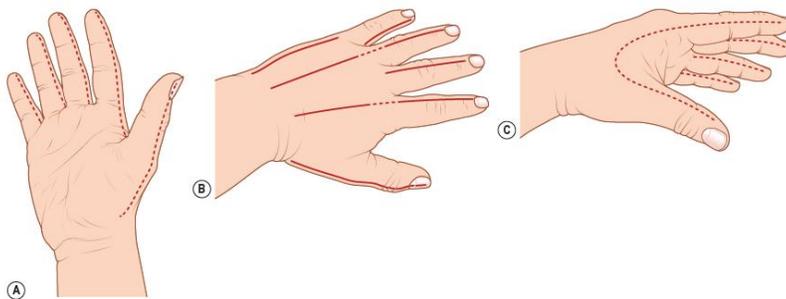
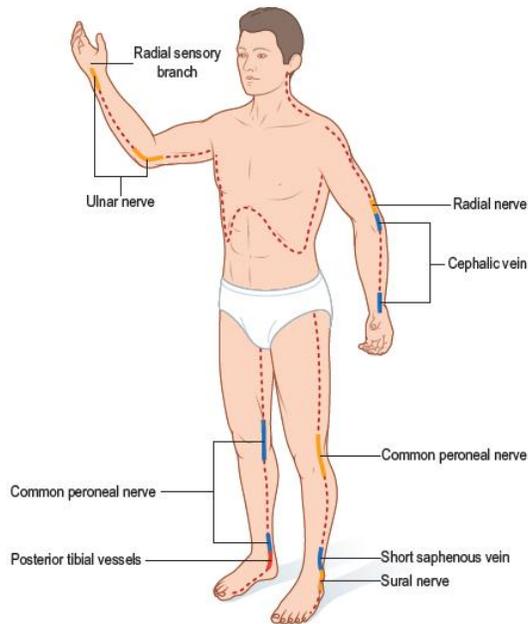


Fig. 18.39 Hand escharotomy incisions: (A,C) lateral view, (B) dorsal view.

### ❑ **Local wound care:**

- **Loose tissue and blisters are debrided. Body and facial hair are shaved if involved in the area of a burn.**
- **Daily wound care is performed on a shower table with soap and tap water.**
- **Use of topical antibiotic:**

The choice of topical burn wound treatment is depend on the depth of bum injury and the goals of management.

- Superficial bum wounds (such as sunburns) require soothing lotions that will expedite epithelial repair such as aloe vera.
  - Partial thickness bum wounds need coverage with agents that will keep the wound moist and provide antimicrobial protection.
  - Full thickness burn are also covered with a topical agent that protects the bum wound from getting infected until the time of burn excision.
- 1) **Silver sulfadiazine:** broad-spectrum antimicrobial coverage, with excellent *Staphylococcus* and *Streptococcus* coverage. It is incapable of eschar penetration, so it is less effect in infected bum wound.  
Side effect: pseudoeschar ,the leukopenia and allergy
  - 2) **Mafenide (Sulfamylon):** it is available as a cream and,5% solution. It has a broad antimicrobial spectrum, including gram-positive and gram-negative organisms. It readily penetrates burn eschar, making it an excellent agent for treating burn wound infections.  
Side effect: a metabolic acidosis and pain on application.
  - 3) **Silver nitrate(0.5%)** provides broad-spectrum coverage against gram-positive and gram-negative organisms. It relatively painless on administration  
Side effect: it stains everything it touches black, electrolyte disturbance and rarely methemoglobinemia.
  - 4) **Bacitracin, neomycin, and polymyxin B** ointments are all commonly used for coverage of superficial wounds
  - 5) **Mupirocin (Bactroban)** is another topical agent that is effective in treating methicillin-resistant *Staphylococcus aureus* (MRSA)
  - 6) **Povidone iodine:** not effective, inactivated by wound exudates.

### ❑ **Nutrition support: Give high calorie and high protein diet .In addition to Vitamins A and C, Iron and Zinc suppliments.**

### ❑ **Psychological support.**

### ❑ **Rehabilitation and physiotherapy.**