

Management of Burn

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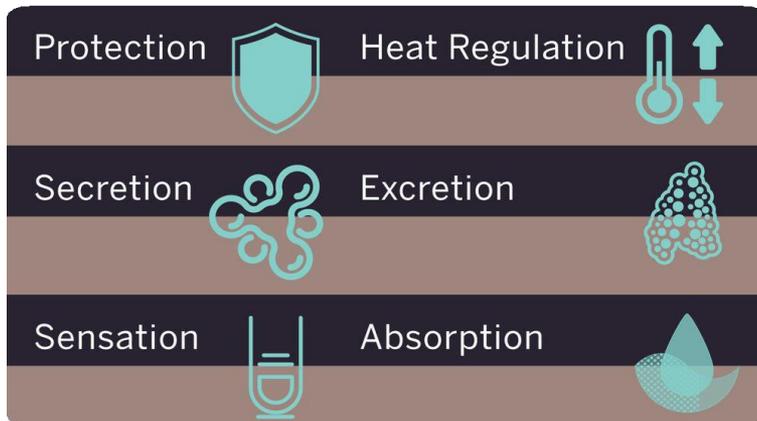
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Skin is the largest organ



- Human skin has many important functions:
 1. **Protection:** protects the body from physical harm, pathogens, and UV radiation.
 2. **Temperature Regulation:** Manages body temperature through sweating and blood vessel dilation/constriction.
 3. **Sensation:** Touch, pressure, temperature, and pain, enabling interaction with the environment.
 4. **Excretion:** Eliminates waste products and toxins through sweat glands.
 5. **Absorption:** Allows for limited absorption of substances like medication.

BURN

- It is a medical condition that happens when there is damage to the skin due to exposure to heat, chemicals, electricity, or radiation. It is characterized by varying degrees of tissue damage, which can result in pain, redness, swelling, blistering, and in severe cases, tissue death.



What Causes Burns?

What are the Types of Burns?

- Thermal Burns
- Chemical Burns
- Mechanical Burns
- Electrical Burns
- Radiation Burns



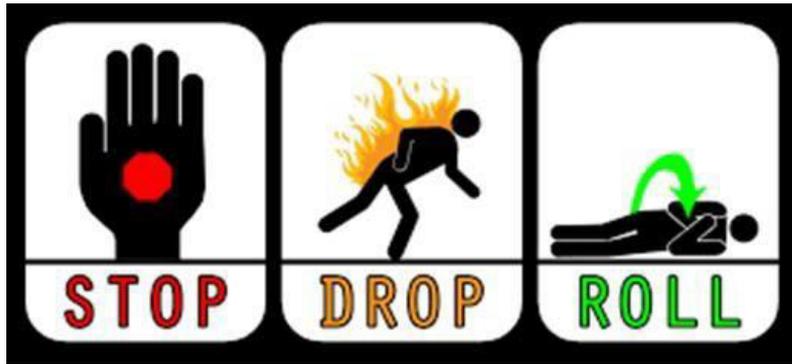
- Burns can be caused by different factors, including:

- 1) Heat.
- 2) Chemicals.
- 3) Electricity.
- 4) Radiation.
- 5) Friction.

Burn complications



- **Airway obstruction**
 - **Inhalation injuries**
 - **Fluid loss**
 - **Hypovolemic shock**
 - **Compartment syndrome**
 - **Limb ischemia**
 - **Infection.**
 - **Intestinal changes .**
 - **Bad scar .**
- 



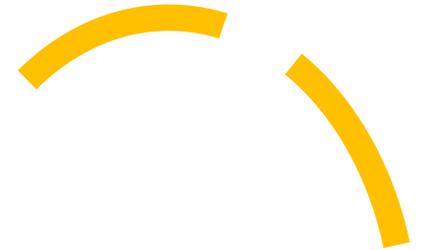
IMMEDIATE CARE OF THE BURN PATIENT



Prehospital care

- The principles of prehospital care are:
- **Ensure safety.** This is particularly important in house fires and in the case of electrical and chemical injuries.
- **Stop the burning process.** Stop, drop and roll is a good method of extinguishing fire burning on a person.
- **Check for other injuries.** A standard ABC (airway, breathing, circulation) check followed by a rapid secondary survey will ensure that no other significant injuries are missed.
- **Cool the burn wound.** This provides analgesia and slows the delayed microvascular damage that can occur after a burn injury. Cooling should occur for a minimum of 10 minutes and is effective up to 1 hour after the burn injury. It should be at about 15°C, and hypothermia must be avoided.
- **Give oxygen.** Anyone involved in a fire in an enclosed space should receive oxygen, especially if there is a change in the consciousness level.
- **Elevate.** Elevation of burned limbs will reduce swelling and discomfort.

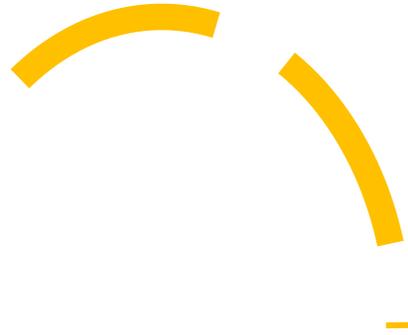




Hospital care -

Initial Assessment

- Mechanism of Injury
- Associated Injuries
- Patient Age
- State of Health





- The principles of managing an acute burn injury are the same as in any acute trauma case:
- **A** —> Airway control.
- **B** —> Breathing.
- **C** —> Circulation.
- **D** —> Disability
- **E** —> Exposure with environmental control.

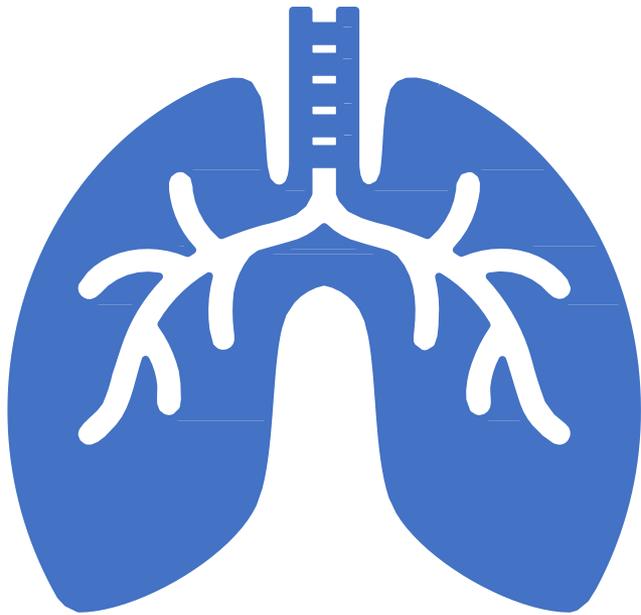
Airway

- The treatment is to secure the airway with **an endotracheal tube** until the swelling has subsided, which is usually after about **48 hours**.
- Early intubation of suspected airway burn is the treatment of choice in such patients. Delay can make intubation very difficult because of swelling.
- The symptoms of laryngeal edema, such as change in voice, stridor, anxiety and respiratory difficulty, are very late symptoms. Intubation at this point is often difficult or impossible owing to swelling, so **cricothyroidotomy** must be performed in patients with a delayed diagnosis of airway burn.

Summary box 41.7

Initial management of the burned airway

- Early elective intubation is safest
- Delay can make intubation very difficult because of swelling
- Be ready to perform an emergency cricothyroidotomy, if intubation is delayed

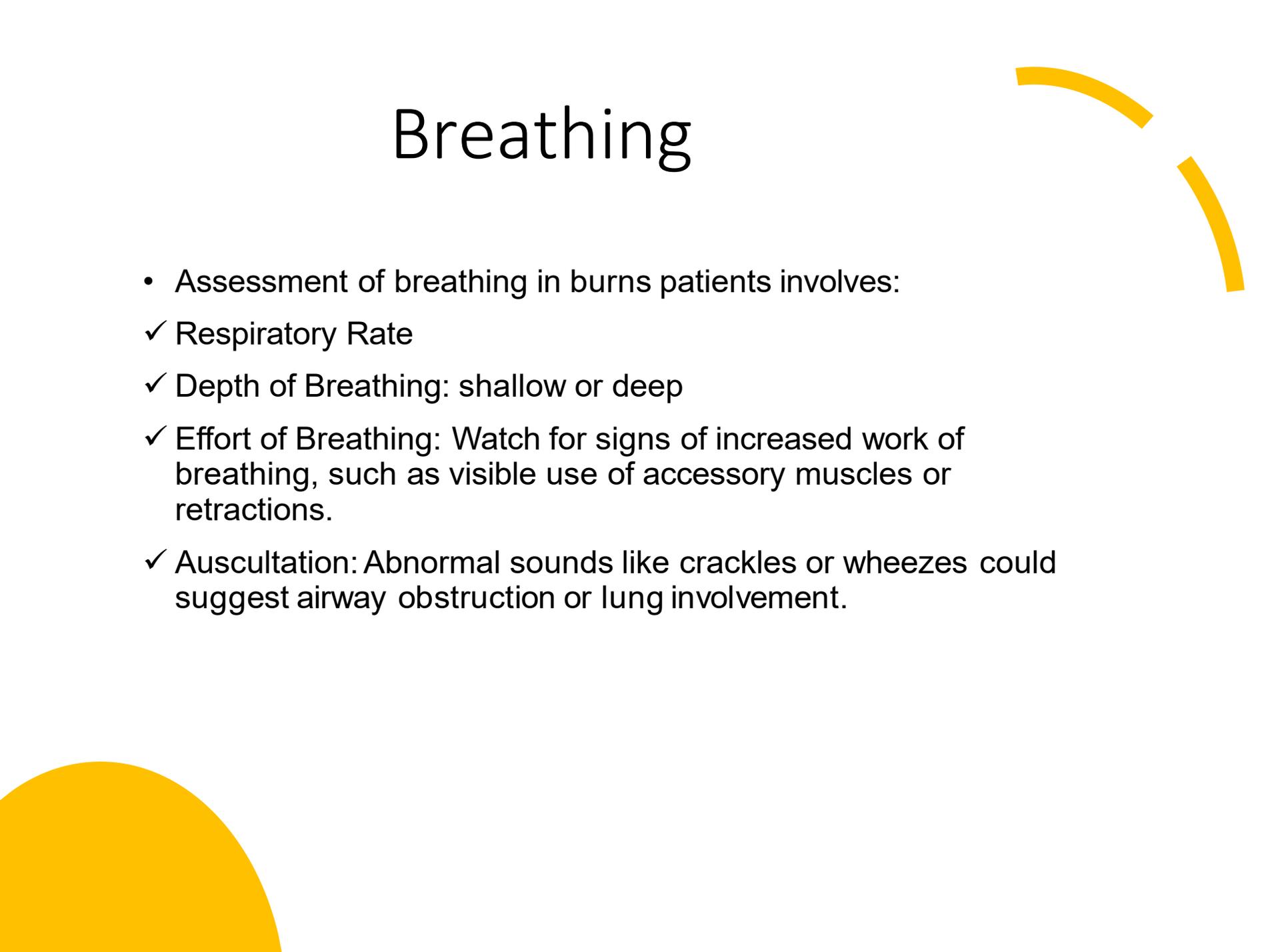


•The key in the management of airway burn is the history and early signs, rather than the symptoms.

•History —> Inhalation of hot gases such as in a house or car fire.

•Physical examination —> blisters on the hard palate, burned nasal mucosa and loss of all the hair in the nose, deep burns around the mouth and neck.

Breathing



- Assessment of breathing in burns patients involves:
 - ✓ Respiratory Rate
 - ✓ Depth of Breathing: shallow or deep
 - ✓ Effort of Breathing: Watch for signs of increased work of breathing, such as visible use of accessory muscles or retractions.
 - ✓ Auscultation: Abnormal sounds like crackles or wheezes could suggest airway obstruction or lung involvement.

Circulation



**** Aggressive and prompt fluid resuscitation ****

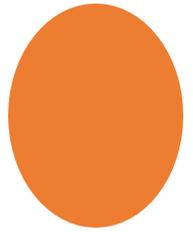
- Risk of hypovolemic shock due to dynamic fluid shifts from the intravascular to extravascular space, and evaporative water loss from the burn injury.

Exposure

Remove all clothing and jewelry



Criteria for
referral to a
burns unit



The criteria for acute admission to a burns unit.

TABLE 41.1 The criteria for acute admission to a burns unit.

Suspected airway or inhalational injury

Any burn likely to require fluid resuscitation

Any burn likely to require surgery

Patients with burns of any significance to the hands, face, feet or perineum

Patients whose psychiatric or social background makes it inadvisable to send them home

Any suspicion of non-accidental injury

Any burn in a patient at the extremes of age

ASSESSMENT OF THE BURN WOUND

ASSESSMENT OF EXTENT AND SEVERITY OF BURNS

Summary box 28.6

Major determinants of the outcome of a burn

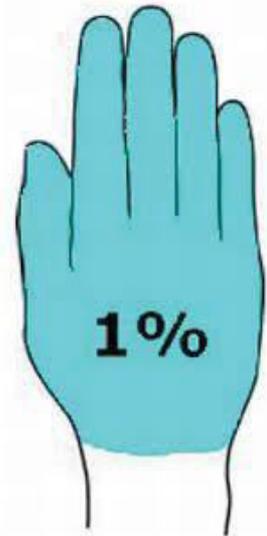
- Percentage surface area involved
- Depth of burns
- Presence of an inhalational injury

• **Percentage of body surface area (BSA) estimation.** The accurate and timely assessment of BSA is a critical aspect of the initial evaluation of burned patients. It will determine whether transfer to a specialized burn center is required as well as the magnitude of initial fluid resuscitation and nutritional requirements

1- rule of the palm :

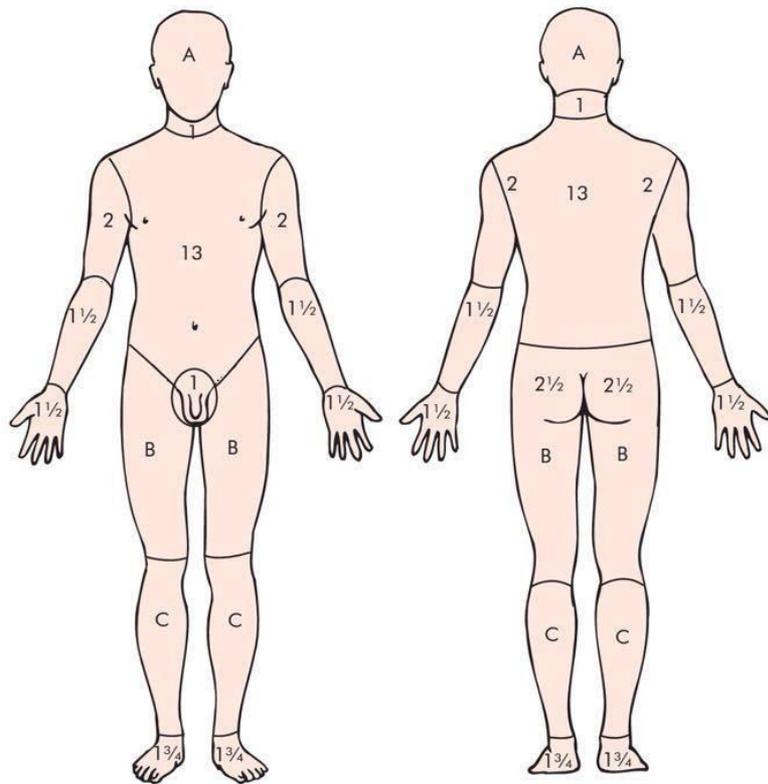
TBSA= total body surface areas

The palm rule = the patients palm accounts for approximately 1% of TBSA, used for estimating **small burns**



2-Draw the burn on a Lund and Browder chart

- which maps out the percentage TBSA of sections of our anatomy.
- It also takes into account different proportional body surface area in children according to age.
- Unlike the Wallace rule of nines, the Lund and Browder chart takes into consideration of age of the person, with decreasing percentage BSA for the head and increasing percentage BSA for the legs as the child ages, making it more useful in pediatric burns.



Relative percentage of area affected by growth

Age in years	0	1	5	10	15	Adult
A Head	9	8	6	5	4	3
B Thigh	2	3	4	4	4	4
C leg	2	2	3	3	3	3

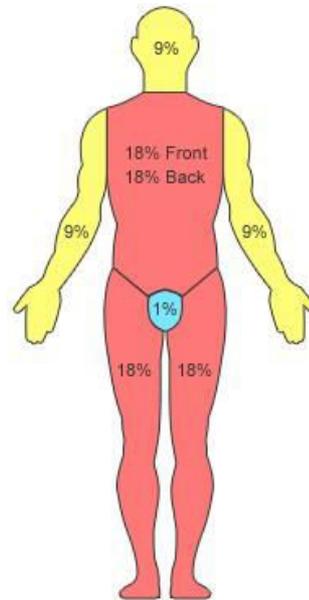
Figure 30.3 The Lund and Browder chart.

- **3-The rule of nines :**

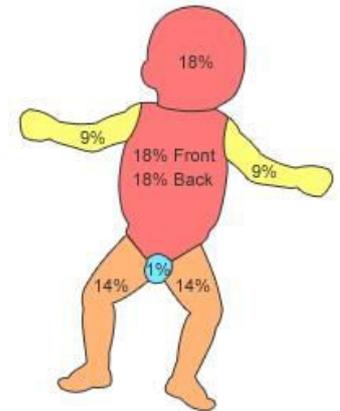
- Divides the adult body's surface into 11 regions

- - each upper limb is 9
- - each lower limb 18
- - The torso 18 each side
- - head and neck 9

- The rule of nines does not accurately account for pediatric proportions in children



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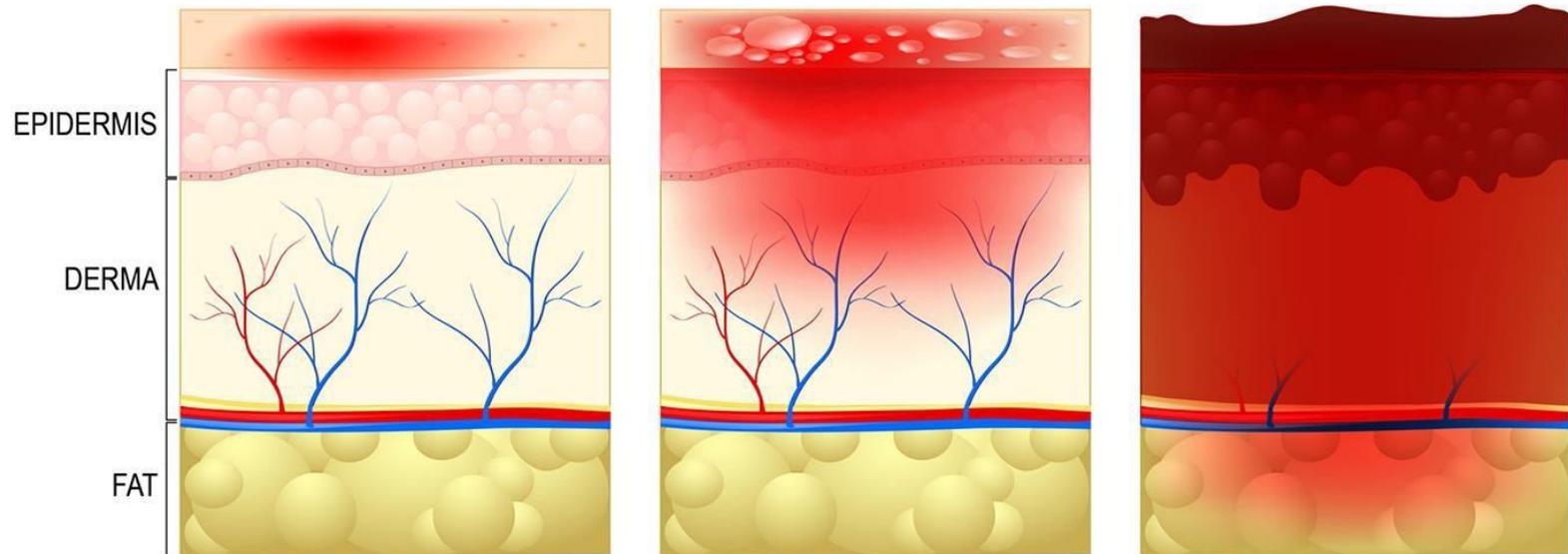


•Assessing The depth of the damage (degree):-

- Burns should be classified and managed based on which layer of skin to which they extend

Cause of burn	Probable depth of burn
Scald	Superficial, but with deep dermal patches in the absence of good first aid. Will be deep in a young infant
Fat burns	Deep dermal
Flame burns	Mixed deep dermal and full thickness
Alkali burns, including cement	Often deep dermal or full thickness
Acid burns	Weak concentrations superficial; strong concentrations deep dermal
Electrical contact burn	Full thickness

SKIN BURN



First-degree
burn

Second-degree
burn

Third-degree
burn

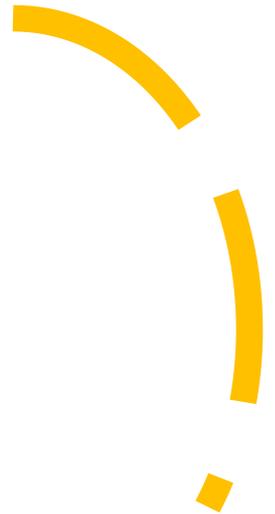
- Classification of burn by its depth:

- **First degree burns:**

thermal necrosis is limited to the epidermis. Clinically, there is pain and erythema. It takes 1-6 days to heal without scarring.

- **Second degree burns:**

partial thickness, necrosis of the epidermis and varying depths of the dermis. It is characterized by pain (due to irritation of the dermal sensory nerves), erythema, blisters (bullae), wet exudates (weeping), blanching (denoting intact dermal vascularity), and preservation of skin elasticity. It takes 1-4 weeks to heal with variable degrees of scarring.



- **Third degree burns:**

full thickness, necrosis of the whole skin and its skin appendages. Clinically, there is an eschar which is simply the burned necrotic skin. It is insensitive, leathery, hard, inelastic, and may show thrombosed dermal vessels. It takes months to heal, and usually leaves significant scarring.

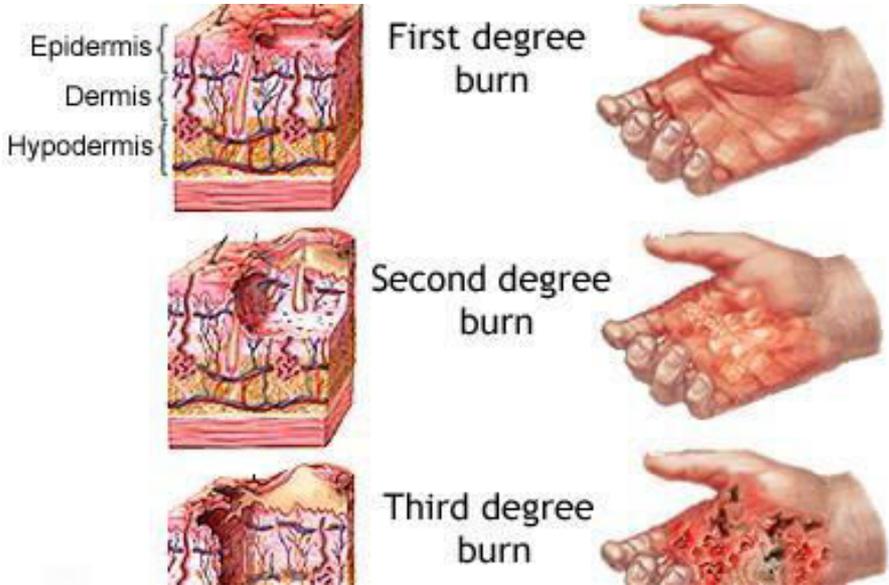
- **Fourth degree burns:**

- - burn injury into bone or muscle

Table 1. Classification of Burns by Depth

Burn Thickness	Deepest Skin Structure Involved	Appearance	Pain	Prognosis (Without Surgical Intervention)
Superficial (first-degree)	Epidermis	Dry, blanching erythema	Painful	Heals without scarring, 5-10 days
Superficial partial-thickness (second-degree)	Upper dermis	Blisters; wet, blanching erythema	Painful	Heals without scarring, < 3 weeks
Deep partial-thickness (second-degree)	Lower dermis	Yellow or white, dry, nonblanching	Decreased sensation	Heals in 3-8 weeks; likely to scar if healing > 3 weeks
Full-thickness (third-degree)	Subcutaneous structures	White or black/brown, nonblanching	Decreased sensation	Heals by contracture > 8 weeks; will scar

Adapted from: Elizabeth Haines, Hilary Fairbrother. Optimizing emergency management to reduce morbidity and mortality in pediatric burn patients. *Pediatric Emergency Medicine Practice*. Volume 12, issue 5, pages 1-23. © 2015 EB Medicine. Used with permission. www.ebmedicine.net.



Management of burns

- ABC
- Supplement oxygen (If carbon monoxide inhalation is suspected)
- Establish venous access
- Investigations
- Fluid resuscitation
- Foley's catheter
- NGT
- Burn care
- Pain control

- **ABC/ O2 supplement:**

- Establishment of secure airway and proper ventilation
- Oxygen. should be provided to patients with all but the most minor injuries. A 100% oxygen high-humidity facemask for those with possible inhalation injury assists the patient's expectoration from dry airways and treats carbon monoxide poisoning.

Signs of inhalation injury:

- Inhalation of superheated air
- Blackish discoloration around mouth ,nose
- Greyish blackish sputum
- Burned nasal hair
- Stridor, hoarseness, dyspnea , persistent hypoxia
- Full thickness circumferential burn to chest wall

- **Establish venous access:**

- All adult patients with burns of 15% or greater or **children** with burns over **10%** TBSA

- require intravenous fluids. Two large peripheral venous catheters should be started immediately to provide circulatory volume support.

- **Laboratory investigations:**

- -CBC

- -Basic metabolic panel (BMP) → Serial BMP in case of myoglobinuria which is nephrotoxicity

- ECG, cardiac enzymes, urine myoglobin in **ELECTRICAL BURN**

- Carboxyhemoglobin, CXR, ABG in **INHALATION INJURY**

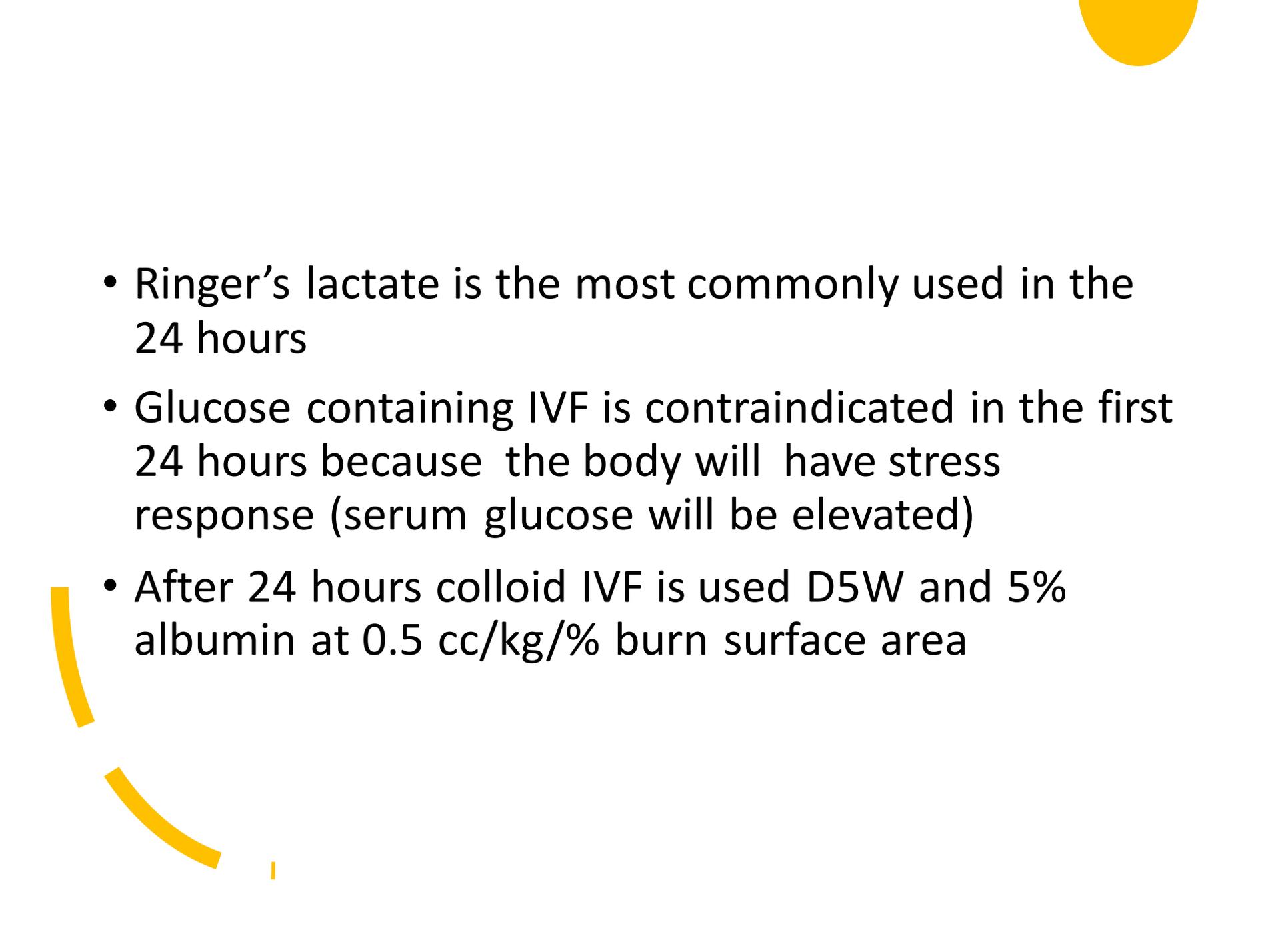
- Fluid resuscitation:
- -Parkland Formula
- The estimated crystalloid requirement for the first 24 hours after injury is calculated on the basis of patient weight and BSA burn percentage.
- Lactated Ringer solution is preferred
- **$V = \% \text{ BSA} \times \text{body weight (kg)} \times 4 \text{ mL/kg}$**
- One-half of the calculated volume is given in the first 8 hours after injury, and the remaining volume is infused over the next 16 hours with adjustments being made as clinical conditions and size/depth of burns evolve.

Example ; adult 100kg , has 20% of his body surface are burn , how much fluid he need ?

- $4 * 100 * 20 = 8000\text{ml}$

4 liter in first 8 hrs

Rest of the volume is given in the next 16 hrs

- 
- Ringer's lactate is the most commonly used in the 24 hours
 - Glucose containing IVF is contraindicated in the first 24 hours because the body will have stress response (serum glucose will be elevated)
 - After 24 hours colloid IVF is used D5W and 5% albumin at 0.5 cc/kg/% burn surface area

- In children, maintenance fluid must also be given to compensate for ongoing evaporative losses and quickly depleted glycogen stores

This is normally dextrose–saline given as follows (maintenance in children)

- 100 ml/kg for 24 hours for the first 10 kg;
- 50 ml/kg for the next 10 kg;
- 20 ml/kg for 24 hours for each kilogram over 20 kg body weight.



Foley's catheter:

-The key to monitoring of resuscitation is urine output.

should be between 0.5-1 ml/kg/hr Adults

1-1.5 ml/kg/hr Children

-If the urine output is inadequate and the patient is showing signs of hypoperfusion (restlessness with tachycardia, cool peripheries and a high hematocrit), then a bolus of 10 ml /kg should be given.

-It is important that patients are not over resuscitated, and urine output in excess of 2 ml/kg/ hour should signal a decrease in the rate of infusion.

Nasogastric tube:

Patient with greater than 20% TBSA burns will develop a paralytic ileus → vomiting → aspiration risk → pneumonia



Treatment depending on the degree

Burn care/ pain control:

- First degree burns: keep clean + topical antibiotic(neomycin)+ pain meds.
- Second degree burns: Remove blisters, apply antibiotic ointment (usually Silver sulfadiazine (Silvadene®)) and dressing, pain meds, Most second-degree burns do not require skin grafting (epidermis grows from hair follicles and from margins) . Newer treatment can be used as well:
 - 1. Biobrane® (silicone artificial epidermis—temporary)
 - 2. Silverlon® (silver ion dressings)
- Third degree burns: Early excision of eschar (within first week postburn) and split thickness skin graft (STSG).



Management of burn wound:

- 1) Early irrigation and Debridement with N.S and sterile instrument .

- 2) Analgesia : All burn patients need good analgesia (IV morphine). Apply cold saline soaks for analgesia if burns are < 25% BSA (watch for hypothermia).

- 3) Topical antimicrobial agent

- 4) Dressing

- 5) +/- tetanus +/- PPI (curling's ulcer)



Burn wound infection:

-Most common organisms are Staphylococcus aureus, Pseudomonas, Strep group A and Candida albicans.

-Swabs should be taken regularly

-A rise in WBC count, thrombocytosis and increased catabolism are warnings of infection , most common discoloration of burn eschar.

-Topical antibiotics are used

-IV antibiotics are contraindicated in fresh burn (bacteria lives in eschar which is avascular, and the systemic antibiotic won't be delivered to eschar)

-Major infections complications:

- Wound infection
- Pneumonia
- Central line infection (should be changed every 3-4 days)
- Conversion a partial thickness injury into a full thickness injury

Topical Agent	Silver Sulfadiazine	Silver Nitrate	Mafenide Acetate
Active Component	1.0% in water-miscible base	0.5% in aqueous solution	11.1% in water-miscible base
Spectrum of Antibacterial Activity	Gram(-), selectively good; Yeasts, good	Gram(-), good; Gram(+), good; Yeasts, minimal	Gram(-), good; Gram(+), good; Yeasts, good
Method of Wound Care	Exposure or single-layer dressings	Occlusive dressings	Exposure
Advantages	Painless; greater effectiveness against yeasts	Painless	Penetrates eschar; no Gram(-) resistance
Disadvantages	Neutropenia; hypersensitivity is uncommon; limited eschar penetration; resistance of certain Gram(-) bacteria and Clostridia	Deficits of sodium, potassium, calcium and chloride; no eschar penetration; staining of environment and equipment	Painful on partial thickness burns; acidosis as a result of inhibition of carbonic anhydrase; hypersensitivity reactions in 7% of patients

- **Escharotomy if needed :**

-It is a surgical incision through the eschar into the subcutaneous tissues to allow the extremity to continue to swell without compressing the underlying blood vessels.

-Areas of concern: Circumferential burns of extremities or thorax .

- **Indications:**

- Impending or established vascular compromise of the extremities or digits.
- Impending or established respiratory compromise due to circumferential torso burns

- **Fasciotomy:**

- Escharotomy may fail, especially when the burn is from high-voltage electrical injury or is associated with soft tissue, bone, or vascular injury.
- If compartment syndrome persists after escharotomy, incision of the fascia is also required.
- General anesthesia is required.

- **Non thermal burn management:**

- **Electrical injury:**

- * Wounds are greater than surface burn

- * Arrhythmias >> cardiac monitoring if history of LOC or ECG abnormalities}

- * Rhabdomyolysis >> ARF

- **Chemical burn:**

- * copious irrigation with tap water ASAP at least 20-30 mins

- * do not try to neutralize the burn (exothermic reaction → thermal burn → worsen the situation)

- * Alkali chemical burns are more serious than acid burns (the body cannot buffer the alkali)

- * Patient with phosphorus burn can absorb the phosphorus → hypocalcemia → arrhythmogenic

Outpatient management:

- No more than 10% TBSA (5% in extreme ages), no involvement of 3rd degree burn
- DISINFECTION, DRESSING, PAIN CONTROL
- Patient is instructed to return if:
 - develops fever
 - worsens of the erythema or pain



THANK YOU

