Burn Approach & Burn Wound Care

Epidemiology:

Burns occur more frequently in vulnerable populations:

children younger than 5 years and

adults 65 years and older.

Epilepsy patients

heavy alcohol users

the poor living in substandard housing.

scald injuries are the most common type in children younger than 5 years,

flame and flash burns becoming more frequent in those 5 years and older.

Primary survey:

A Airway	Chin lift Jaw thrust Oropharyngeal airway placement (unconscious patient) intubation
B Breathing	Chest auscultation Start high flow 100% oxygen using a non-rebreather mask Circumferential full-thickness burns of the trunk and neck
C Circulation	Assess circulation by blood pressure, pulse rate, and skin color (of unburned skin) Insert a large bore intravenous catheter The initial fluid rates (=/<5y : 125 ml/h , 6-13y : 250 ml/h, =/>14y : 500 ml/h) of LR.
D Neurology deficit	AVPU method: Alert, responds to verbal stimuli, Respond only to painful stimuli, Unresponsive burns are initially alert and oriented. If not, consider associated injury
E Exposure	Exposure and completely undress the patient. Examine for major associated injuries. Maintain a warm Environment.

Secondary survey:

History (AMPLE, Detailed history)

Accurate pre-injury patient weight

Determination of the burn depth and percent Total Body Surface Area burned

Apply adjusted fluid rates after TBSA determination

Complete head-to-toe evaluation of the patient

Obtain indicated labs and X-rays

Monitor fluid resuscitation and extremity perfusion

Pain and anxiety management

Psychosocial support

Wound care, use of systemic antibiotic, and tetanus toxoid vaccine.

The burn is often the most obvious injury, but other serious and even life-threatening injuries may be present.

INITIAL STUDIES:

Urinalysis for pregnancy, toxicology, and in diabetics

Chest X-Rays in intubated patients

Under specific circumstances, additional specialized tests are appropriate:

ABG with Carboxyhemoglobin level (Carbon Monoxide) if inhalation injury is suspected

ECG – With all electrical burns or pre-existing cardiac problems

Type and screen (or cross) for associated trauma

Management Principles and Adjuncts

Urinary Catheter, Nasogastric Tube, Monitor vital signs

Monitoring Extremity Perfusion

INITIAL CARE OF THE BURN WOUND

the primary goal is to avoid hypothermia. Also, covering all burn wounds prevents air currents from causing pain in sensitive partial thickness burns.

Adjusted fluid resuscitation:

Burn hypovolemic shock: Caused by shift of fluids from the INTRA-VASCULAR to INTERSTITIAL compartment due to increase capillary permeability, or loss of the capillary integrity (THIRD SPACE LOSS).

Severity depends on the percentage of burn.

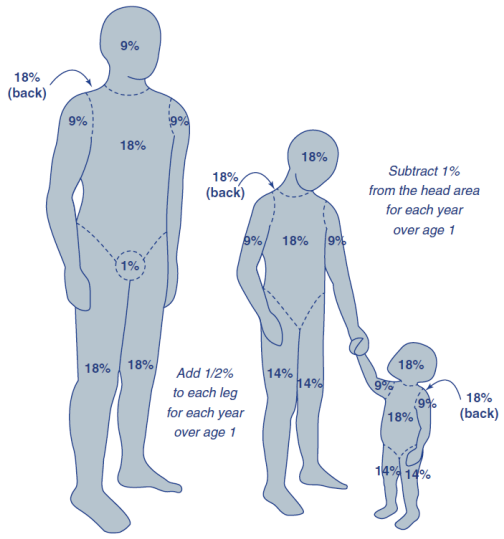
Total body surface area burned (TBSA): It is important to estimate the size of a burn initially to guide:

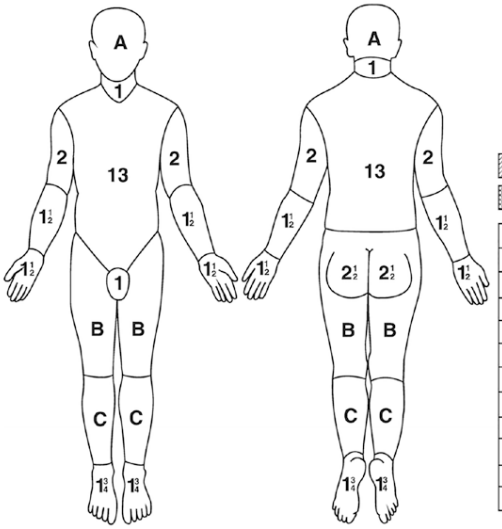
transfer to definitive care

fluid resuscitation

caloric needs

prognostic information





Superficial
Deep

REGION	%
HEAD	
NECK	
ANT.TRUNK	
POST.TRUNK	
RIGHT ARM	
LEFT ARM	
BUTTOCKS	
GENITALIA	
RIGHT LEG	
LEFT LEG	
TOTAL BURN	

RELATIVE PERCENTAGE OF BODY SURFACE AREA AFFECTED BY GROWTH

AREA	AGE 0	1	5	10	15	ADULT
A = ½ OF HEAD	9½	8½	6½	5½	4½	3½
B = ½ OF ONE THIGH	2¾	3¼	4	4½	4½	4¾
C = ½ OF ONE LEG	2½	2½	2¾	3	3¼	3½

exclude superficial burns (First-degree burns) from the TBSA calculation.
Scattered burn using the size of patient palm 1%

Parkland formula:
This calculates the fluid to be replaced in
the first 24 hours by the following formula: total percentage
body surface area × weight (kg) × 4 = volume (mL).

Half given in the first 8hr and the remainder over the following 16hr starting from time of burn onset.

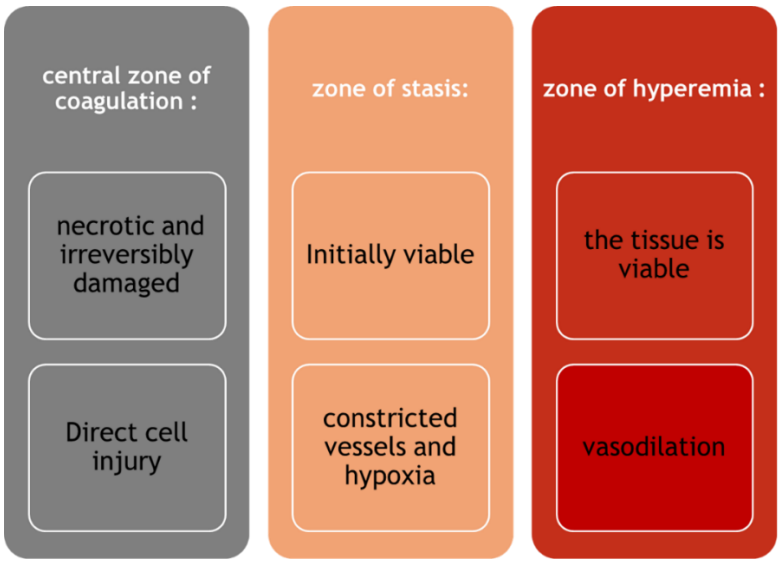
Check the patient's urinary output and physiological response to decide further fluid titration. It is better to increase fluids based on response than to attempt to remove excess fluids once given.

Fluid Over-Resuscitation and Fluid Creep:

- Abdominal compartment syndrome (ACS).
- Extremity compartment syndrome.
- Respiratory failure and prolonged intubation.
- Pulmonary edema and pleural effusions.
- Orbital compartment syndrome.

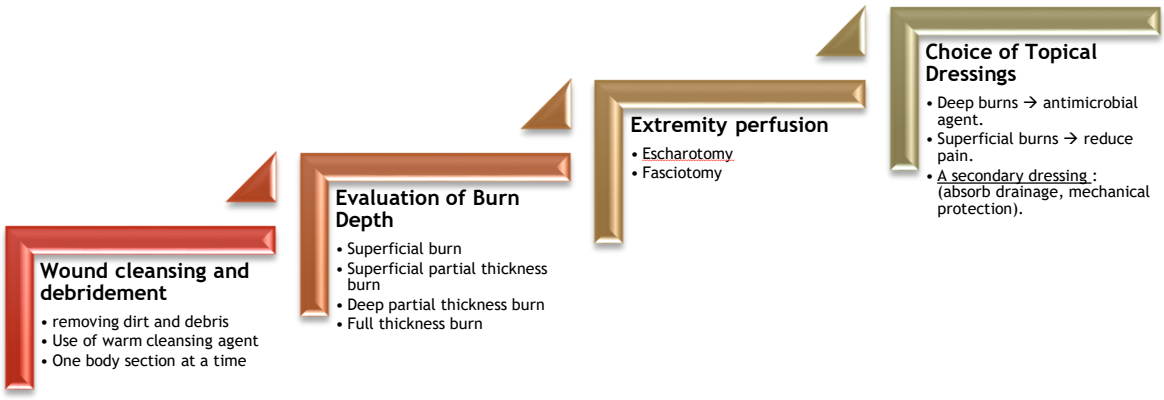
Urine output is the most sensitive indicator of tissue perfusion.
In adults it should be 0.5-1 ml / kg / hour, in children it should be 1-2 ml / kg / hour.
Higher urine output may indicate over resuscitation that leads to harmful tissue edema.

Jackson's classification of zones of injury:



this tissue may convert to coagulation or a full-thickness injury as a result of
edema,
infection, or
shock with decreased perfusion.

Evaluation and Early Management of Burn Wound:



Escharotomy:

Clinical signs of impaired perfusion in the burned extremity/hand:

cool temperature

decreased or absent capillary refill

tense compartments

the hand held in the claw position

the absence of pulses is a late sign

Escharotomies of the extremities are performed along the medial and lateral lines, with the extremity held in the anatomic position

Escharotomies of the hand is performed along the second and fourth metacarpals

Escharotomies of fingers, care is taken to prevent any injury to the neurovascular bundle; therefore, are typically not performed along the ulnar aspect of the thumb or the radial aspect of the index finger.

ANTIBIOTICS:

Are used to treat infections, but not prophylactically

Prophylactic antibiotics are contra-indicated in burns, for the following reasons:

- Studies did not prove that prophylactic antibiotics decrease the incidence of sepsis.
- Antibiotics increase the incidence of fungal infections.
- Antibiotics increase the incidence of bacterial resistance.

ANALGESIA AND SEDATION:

A sort of pain and anxiety relieve, is needed in the burn victim, even in those with full thickness burn,

the following guidelines are to be applied:

1.In patients with low tissue perfusion, the drugs should be administered by the intra-venous route to avoid accumulation of the drug.

2. Given in increments of small doses, till the required dose is reached.

3.Head injury, hypoxia, and shock all have the same symptomatology of pain, so these should be ruled out before treating pain.

ABA criteria for referral to a burn center:

1. Partial-thickness burns greater than 10% of TBSA
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints.
3. Third-degree burns in any age group.
4. Electrical burns, including lightning injury.
5. Chemical burns.
6. Inhalation injury.
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality.
8. Any patient with burns and concomitant trauma (such as fractures).
9. Burned children in hospitals without qualified personnel or equipment for the care of children.
10. Burn injury in patients who will require special social, emotional, or rehabilitative intervention.

Burn wound care and Management

Objectives of burn wound care:

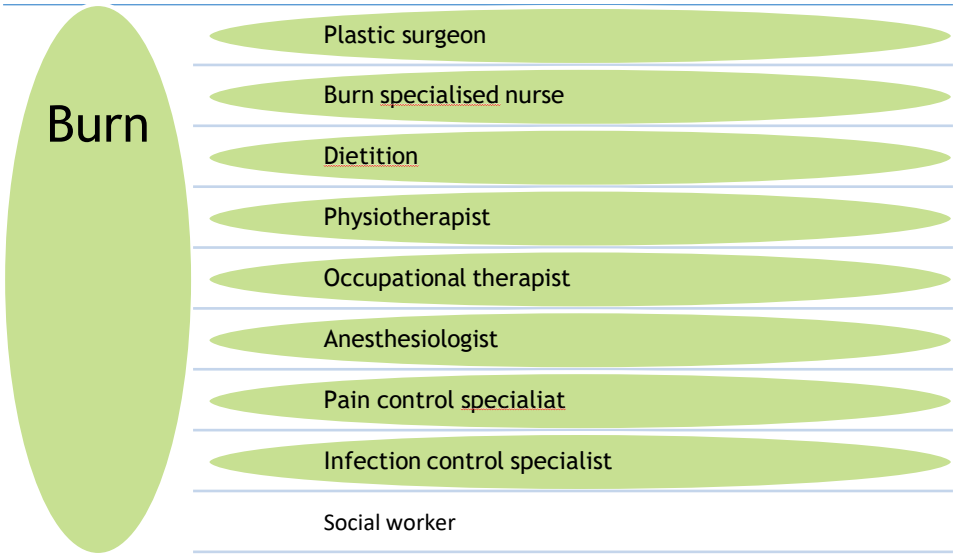
Prevention of conversion

Removal of devitalized tissue

Preparation of healthy granulation tissue

Minimization of infection

Limitation of scars and contractures



Typical clinical appearance of burn depth

Superficial (first-degree) burns	never blisters Appears as a "sunburn" Painful	Involves only the epidermis Is not included in the %TBSA calculation	require no dressing treated with topical ointments decrease pain and keep the skin moist. **It takes 1-6 days to heal and leaves no scars**
Partial-thickness (second-degree) burns	Superficial Pink, homogeneous, normal cap refill, painful, moist, intact hair follicles	involve the papillary dermis.	will heal spontaneously, with minimal hypertrophic scarring, 2–3 weeks if the wound remains free of infection. Daily assessment
	Deep Mottled or white, delayed or absent cap refill, dry, decreased sensation or insensate, non-intact hair follicles	extend to the reticular dermis	may require more than 3 weeks to heal. Daily assessment **grafting may be required.**
Full-thickness (third-degree) burns	Dry, white or charred, leathery, insensate Even if mottled in appearance, they do not blanch.	extend through the entire dermis into subcutaneous tissue.	require excision and grafting. **These wounds require excision of the burn eschar and skin grafting for closure.**

Burn Wound Excision & Wound Coverage

skin excision within 72 h after injury leads to best results.

Autografting is the gold standard for burn wound coverage.

Patients with large TBSA various biological and synthetic substrates to replace the injured skin post-burn

Epidermal Substitutes

Dermal Substitutes

Composite (Epidermal/Dermal) Substitutes

Burn Wound Excision & Wound Coverage

Advantages of early escharectomy and grafting:

Decrease the duration of hospital stay.

Decrease the incidence of burn wound sepsis, by elimination of the dead tissue and bacteria.

Helps early mobilization of the patient, decreasing joint contractures.

Shortens the catabolic state, minimizing the protein breakdown, and malnutrition.

Better cosmetic outcome.

Burn wound care and management

The choice of dressing is based on the characteristics of the wound:

Common topical agents:

Silver sulfadiazine:

the most commonly used agent

Advantages:

broad spectrum of activity,

soothing effect in most patients, and

no significant metabolic activity.

Disadvantages:

does not penetrate eschar, so it does not treat established wound infections.

neutropenia.

sulfa-allergic patient.

Mafenide acetate:

Advantages:

penetrates eschar and is therefore useful for the treatment of burn wound infections

broad spectrum of activity against gram-negative organisms.

Disadvantages:

Mafenide acetate is a carbonic anhydrase inhibitor that may cause metabolic acidosis when used on large areas.

painful on application, particularly to partial-thickness burns.

Silver nitrate:

broad spectrum of activity

Disadvantages:

Dressings need to be repeatedly impregnated with aqueous solution to prevent precipitation onto the wound.

Concentrated silver nitrate may cause

chemical burns and

hyponatremia,

methemoglobinemia.

Wounds, normal skin, and linens will be stained black

Types of burn:

1) Thermal:

Flame:

generally, result in deep dermal or full-thickness injury because of the duration of exposure.

ignition of bedding or clothing are common causes of flame burns, and burn depth is proportional to the time required to remove the burning or smoldering material from the victim.

Intoxication or carbon monoxide (CO) poisoning occurring during a house fire increases the likelihood of deep flame burns.

Heat causes coagulative necrosis of tissue by coagulation of the cellular proteins. ▪Characterized by preservation of the shape of the tissue. ▪The depth (degree of burn) depends on the quantity of heat (temperature and duration of exposure), so exposure to a relatively lower temperature for long period may cause more damage than exposure to high temperature for a short period.

Scald:

are the second most common cause of burns

The depth of injury is related to water temperature and the duration of contact.

Clothed areas may be scalded more deeply because of prolonged contact with wet fabric before removal.

Hot oil and grease burns tend to be deep partial or full thickness because of the very high temperatures reached while cooking or heating oil.

diabetic patients may accidentally scald themselves when soaking neuropathic or insensate feet in hot water.

Contact:

result from direct contact with a heat source.

occur in children or impaired individuals (drugs, alcohol).

Palmar or plantar surface

Flash:

Explosions caused by natural gas, propane, and gasoline vapors generate brief, intense heat.

If not directly ignited, clothing is protective, with burns affecting only exposed skin.

The depth of injury can be variable; many flash burns heal without grafting.

Frost bite:

Affection of the peripheries in cold climates

Delayed microvascular damage

Conservative management until absolute demarcation of injury level

Rewarm affected areas in gently circulating water at 40-42°C for 15-30 minutes.

Provide pain medication and leave blisters intact

Determining the extent of damage is difficult, and surgery is usually not considered until there is clear demarcation of the injury.

2) Inhalation injury:

significantly increases mortality in patients when combined with cutaneous burns.

Upper airway:

occur as a result of thermal injury, as well as the toxic substances in smoke.

The capacity for the oropharynx to absorb heat generally prevents thermal injury from extending lower into the airway.

diagnosed by direct laryngoscopy and, if significant, is an indication for prophylactic endotracheal intubation

Airway edema is maximal 12 to 24 hours after injury,

Short courses of steroids may be administered to patients without significant burns.

Lower airway:

occur as a result of thermal injury, as well as the toxic substances in smoke.

The capacity for the oropharynx to absorb heat generally prevents thermal injury from extending lower into the airway.

diagnosed by direct laryngoscopy and, if significant, is an indication for prophylactic endotracheal intubation

Airway edema is maximal 12 to 24 hours after injury,

Short courses of steroids may be administered to patients without significant burns.

Carbon monoxide:

poisoning is commonly seen in burn victims, as well as in no burned patients exposed to exhaust in a variety of domestic and occupational environments.

CO toxicity correlates with levels of arterial carboxyhemoglobin.

higher affinity (200 fold) of the CO molecule than the oxygen molecule for hemoglobin.

The treatment of CO toxicity is 100% oxygen, which shortens the half-life of carboxyhemoglobin from 4 hours to 45 to 60 minutes.

3) Chemical:

Acids: cause coagulation necrosis with precipitation of protein, creating an impermeable barrier that limits further penetration of the acid.

Alkali: alkali cause 'liquefaction' necrosis allowing the alkali to penetrate deeper into the injured tissue. The presence of hydroxyl ions within these tissues increases their solubility, allowing alkaline proteinases to form when the alkalis dissolve the proteins of the tissues.

The severity of a chemical burn injury is determined by several factors:5

1. Concentration of chemical in contact or ingested
2. Quantity of chemical agent
3. Manner and duration of contact (skin or ingestion)
4. Extent of penetration
5. Mechanism of action of the chemical

6. Physical state of agent (liquid, solid, gas).

In general, alkaline materials cause more injury than acidic compounds.
removal of all potentially contaminated clothing and copious irrigation.
The use of neutralizing agents is generally contraindicated

In addition to cutaneous injury, some chemical agents may be absorbed and result in systemic illness.

Ammonia === ARDS
Chromic acid === Renal and hepatic failure as well as anemia
Formic acid === metabolic acidosis, hemolysis
Phenol (carbolic acid) === seizures

4) Electrical burn:

Electrical burns differ from thermal or chemical burns in that they cause much more subdermal damage

Electrical burn sometimes causes mild skin damage but there can still be severe internal organ and tissue damage

Generally, the pathway of the current will follow the course of the least resistant tissues: firstly, nerves, blood vessels, and muscle, then skin, tendon, fat, and bone

electrical burns have an entry point and an exit point

Low voltage:

may cause local tissue injury but rarely lead to systemic injury.

High-voltage injuries

may cause unpredictable patterns of local injury,

deep tissue destruction belied by the small size of the skin wounds

full-thickness cutaneous wounds at entry/exit sites and areas

musculoskeletal injuries from severe tetanic contractions

Complications:

1 infection (which can progress to sepsis)

2 compartment syndrome (require fasciotomy)

3 Rhabdomyolysis (due to extensive muscle damage).

4 Lung Injury.

5 Cardiac complications