

REVIEW ARTICLE

Management of Burns

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ABSTRACT

Skin is an essential organ of our body & performs many vital functions. It consists of epidermis & Dermis. Epidermal and burns to superficial part of dermis heal very well with no or minimal scarring. Burns to deep dermis usually heal with hypertrophy and contractures. When skin is burnt, all vital functions of skin are lost. Burns of the face usually heal well due to presence of high proportion of papillary dermis. They should be protected from sunlight. It is known that reticular layer of dermis comes to the defense and protects against formation of contractures. It is also proved that thin layer over eyelids, face and neck is responsible for development of contractures. Thick layer of skin over buttocks & back protects against developing contractures. We should remember that once a scar, it is always a scar. It may not be possible to remove the scars completely, but we can minimize the burn scar. Management of burns includes, management at the site of injury, management in emergency room, management in ICU (intensive care unit), HDU (High dependency unit) and also wards. Meticulous dressings to be done as and when required. When all the wounds have healed advice for massage with oil or moisturizer, active physiotherapy, provision of cervical collar, splints and pressure garments. We should check for compliance of the treatment at regular intervals. Counselling of the patients requires utmost attention. Psychological support and rehabilitation is very essential as many patients may go for psychiatric illnesses. Secondary surgery for correction of deformities after 6 months or as per indication is mandatory.

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INTRODUCTON

Burns occur universally. Incidence is on the increase with the complexities of modern living and industrialization. Burn injuries are a major challenge to most hospital medical and nursing staff. The physiologic response to injury is complex and the cost of treatment is exorbitant. Although burn is a major problem in India, it has not received the attention it deserves, probably due to the cost of hospitalization and care which imposes a

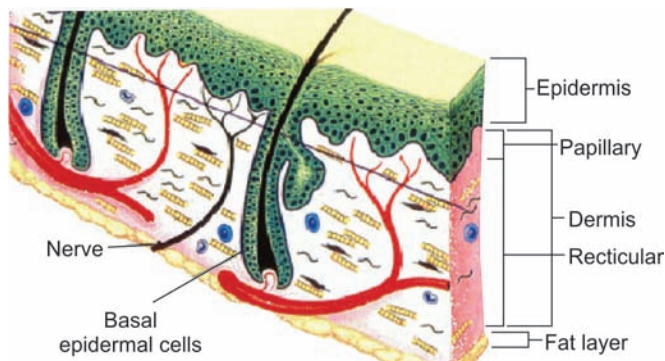


Fig. 1: Anatomy of skin and its layers

severe burden on the limited resources. The treatment is painstaking, expensive, and can still lead to deformity, disfigurement, disability, prolonged rehabilitation, loss of income, job, and an enormous financial burden to the families. Since most of the burns occur either at home or at the workplace, it is important for everyone to know the first aid management of burns.

Skin is an essential organ of our body and performs many vital functions. Skin is composed of epidermis and dermis (Fig. 1). Burns confined to epidermis and superficial part of dermis heal well with no or minimal scarring. Burns involving deep dermis heal with hypertrophy and contractures. With burns, all vital functions of skin are lost. Facial burns almost always heal well due to the presence of high proportion of papillary dermis. They should be protected from sunlight. Reticular layer of dermis protects against formation of contractures; thin layer over face, eyelid, and neck is responsible for development of contractures; and thick layer over buttocks and back protects against developing the same.

DEFINITION OF BURN

Burn is a type of injury to skin caused by heat, scald, chemicals, electrical, radiation, and friction. It results in coagulative alteration of proteins due to wide range of temperatures, ranging from the lowest, i.e., frostbite, to the highest, i.e., electrical injury. Thus, both extremes of heat and cold can cause burn injury.

Types of Burn Injury

- Thermal or flame burns occur due to dry heat.
- Scald burns are due to hot liquids, mostly in children by knocking hot liquids onto themselves.
- Chemical burns are caused by strong acids and alkali. It causes tissue damage by denaturation of the cell

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Fig. 2: Degrees of burn



Fig. 3: First-degree burn



Fig. 4: Second-degree superficial burn



Fig. 5: Second-degree deep burn

protein. Chemical burns are unique because there is continuous tissue damage. Immediate removal of clothes and continuous irrigation for at least 30 minutes with water is the most effective measure of first aid management.

- Electrical burns can be flash, arc, or contact. The flash may ignite clothes and hence burns may be superficial. In contact burns, the person comes in contact with live wires. The current enters the body through nerves and vessels and exits at another site.

Classification

Burn injury is classified into first-degree burn, second-degree burn, and third-degree burn (Figs 2 to 6).

The depth of burn determines the type of healing besides being a prognostic factor.

First-degree Burn

- Epidermis alone is involved
- Erythema—The skin is usually red



Fig. 6: Third-degree burn

- Edema—Often there is swelling
- Heals spontaneously in 7 days.

Second-degree Burn

Involves the epidermis and part of the dermis. Depending on the depth of dermal involvement second-degree burn

injury can be divided into superficial second degree and deep second degree.

A superficial second degree burn heals spontaneously in about 7 to 14 days. It is characterized by

- Blisters/blebs and bullae
- Severe pain and swelling
- Pink color, as the dermal plexus is seen through the skin.

A deep second-degree burn heals in about 14 to 21 days, but if infection sets in, then it can become deep.

Third-degree Burn

It involves the whole of the epidermis and whole of dermis. Fat, muscle, and even bone may be affected. Areas may be charred black or appear dry and white. Coagulated veins may be seen. It is painless and leathery to feel. Third-degree burn injury requires surgical intervention to cover the burned area.

ESTIMATING BURN SIZE

Lund and Browder is used to calculate the percentage of burns in children.

Wallace’s “Rule of Nines” is used to calculate the percentage of burns in adults (Fig. 7).

For adults, Wallace’s “Rule of Nines” is commonly used. According to this, head and neck constitute 9% of total body surface area, each upper extremity is 9%, each lower extremity is 18%, and anterior and posterior trunk are 18% each, and 1% for the genitalia.

PATHOPHYSIOLOGY OF BURN SHOCK

Following burn injury, the skin and the deeper structures are destroyed by heat resulting in increased capillary permeability leading to fluid loss, electrolyte loss, and protein loss, which leak from the intravascular to interstitial space.

Inadequate volume resuscitation will produce hypovolemia, resulting in low cardiac output and

inadequate tissue perfusion. The goal of resuscitation is to maintain vital organ function: the best guide of adequate resuscitation is the hourly urine output of 0.5 mL/kg/hour.

Pathophysiology of Burn Injury can have Two Types of Effect

1. Local effects—Inflammatory mediators are released from capillary wall resulting in vasodilatation and increased capillary permeability leading to fluid loss.
2. Systemic effect—Includes hypovolemia, immunosuppression, catabolism, pulmonary edema, and loss of the protective function of the gut.

FLUID RESUSCITATION

Requirement for Fluid Calculation

- Weight of patient
- Percentage of burns—Rule of Nines
- Time of burns.

Fluid Calculation by Modified Brooke’s Formula

First 24 Hours

Burn requirement = Weight (in kg) × percentage of burns × 2 mL

Plus normal requirement = 2,500 mL (Normal requirement of 2,500 is because of insensible loss like: lungs—500 mL, skin—500 mL, urine—1400 mL, feces—100 mL)

Example: 50 kg × 50% × 2 = 5,000 mL

Normal = 2,500 mL

Total = 7,500 mL

Second 24 Hours

Burn requirement = Weight (in kg) × percentage of burns × 1 mL (half given as colloid and half as crystalloid)

Plus normal requirement = 2,500 mL

Third 24 Hours

- 5% Dextrose 2,000 mL plus
- Normal saline 500 mL
- Injection KCl, 3 gm

NUTRITION

Nutritional support (Fig. 8) is vital for the successful management of the burn patient and it requires special attention. Early nutritional support has been shown to reduce mortality and hasten the recovery of the patient. Nutritional requirements are higher among burn patients, owing to the hypermetabolic and other pathophysiologic responses that occur after the thermal

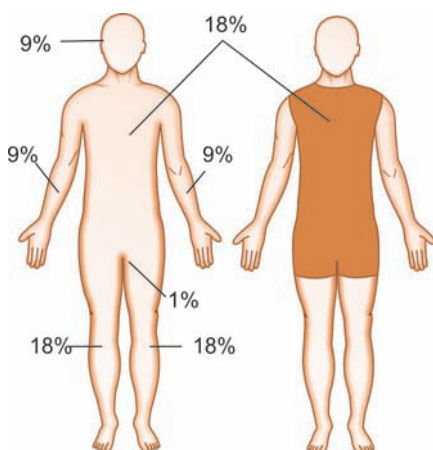


Fig. 7: Percentage of burns





Fig. 8: Nutrition supplementation



Fig. 9: Healicol biological sheet



Fig. 10: Healicol over donor site



Fig. 11: Wound healed in 5 to 7 days

injury. An aggressive nutritional support is mandatory to provide optimal condition for wound healing, immunocompetence, and ultimate well-being of the patient. A high-protein, high-carbohydrate, low-fat diet with supplementation of vitamins A and C, trace elements, and zinc is advocated.

BURN WOUND CARE

Burn wound differs from other wounds in the following:

- Area is extensive.
- It is open for long periods and prone for infection.
- It has large amount of dead tissue and discharge from wounds.
- The depth of burn wound depends on the temperature and the duration of contact of the burning agent.

Second-degree Superficial Burns

- De-roofing the blister, removing the fluid, and retaining the skin are important as the blister fluid contains inflammatory mediators known to be detrimental to the microcirculation in the zone of stasis.
- If blister is already debrided, wound should be cleaned and a nonadherent dressing applied. Wound healing

can also be hastened by using biological skin substitutes like Amnion, Biobrane, and Healicol (Figs 9 to 14).

Second-degree Deep Burns

Second-degree deep burn injury can heal spontaneously in 3 weeks. If it does not heal even by the end of 3 weeks, then wounds should be treated by tangential excision (Fig. 15) and skin grafting.

Third-degree Burns

- Complete destruction of all epidermis and dermis
- Breakdown of hemoglobin results in many colors on the wound
- Appearance of skin may be waxy, dry, leathery, charred, or translucent. Thrombosed veins are seen on the skin surface
- Prompt burn wound excision and autograft is the best option.

FIRST AID

- Pour running tap water for at least 20 minutes
- If running water not available, stop, drop, and roll to put off the flames.



Fig. 12: Application of Healicoll sheet

- Remove clothing and jewelry—clothing can hold heat on the burn and if swelling occurs jewelry can stop blood flow to the burn.

PREVENTION AND FIRST AID MANAGEMENT OF BURNS

Burn injuries are universal and incidence is on the increase with the complexities of modern living and industrialization, since most of the burns occur either at home or at the place of work. It becomes important to know about burn prevention and first aid management.



Fig. 13: Second-degree wound

Burns are caused by a variety of agents like flame, hot liquids, chemicals, and electricity. The priority of treatment is to stop the burning process by using tap water, which reduces the severity in all types of burns except in electrical cases, where the patient is removed from the source of electrical current.

ANSWERS TO SOME OF THE COMMON QUESTIONS

- What causes burns?
Burns can be caused by flame, acid, hot liquids, and electricity.
- What to do immediately following burns?
Priority is to stop the burning process by using tap water.
- Can water cause blisters?
No. Blisters indicates that burns are superficial and will heal spontaneously.
- What to apply on the burnt surface?
Apply ointments like Neosporin, Soframycin, and Silver sulfadiazene. Do not apply gentian violet, ink, ghee, calamine, lotion, salt, toothpaste, etc.

DO'S

- Pour water to stop the burning process.
- If no water is available, stop, drop, and roll.

DONT'S

- Do not play with matches, kerosene, fire crackers, and electricity.
- If gas leak is suspected in the kitchen, do not strike a match or put the electrical switch on. Open the windows and tighten all gas valves. If it is still leaking, call the gas company.
- Do not allow children near hot silencer.
- Do not use loose pressure cooker rubber (casket) (Fig. 16).



Fig. 14: Sixth day after Healicoll application



Fig. 15: Tangential excision and grafting

- Do not carry hot water on a slippery floor.
- Do not leave gas inlet open when not in use.
- Never leave a child unattended in the bathroom.
- Do not keep open fire near the bed on a winter night (Fig. 17).
- When you go on long leave, disconnect the plug of radio, television, and other electrical appliances.
- Do not pour kerosene or petrol to revive fire (Fig. 18).
- Do not keep the test tube close to your face in chemistry lab.

AVOID

- Avoid cooking on floor level (Fig. 19).
- Avoid leaving unattended hot liquids.
- Avoid live wires (Fig. 20).
- Avoid children playing in the kitchen (Fig. 21).
- Avoid wearing loose garments in the kitchen (Fig. 22).
- Avoid storing cooking materials across the stove.
- Avoid using sari to handle vessels.

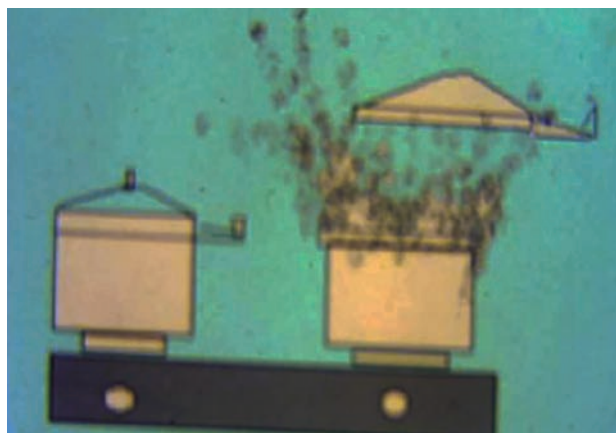


Fig. 16: Pressure cooker with loose rubber



Fig. 17: Cigarette smoking



Fig. 18: Kerosene lamp toppling by rat or cat



Fig. 19: Close floor-level cooking and wearing a loose saree



Fig. 20: Loose wire on floor

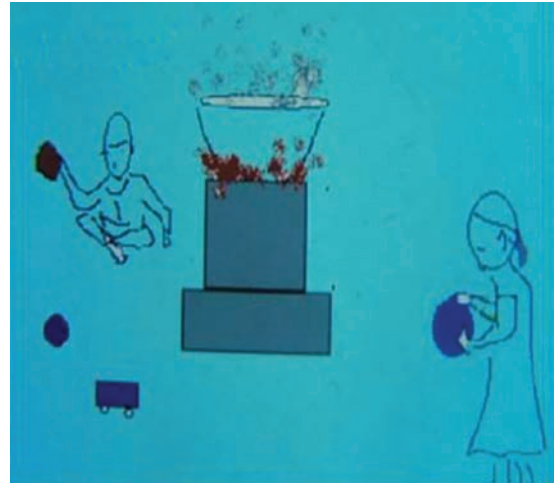


Fig. 21: Do not allow children to play in kitchen



Fig. 22: Do not use saree to hold vessel

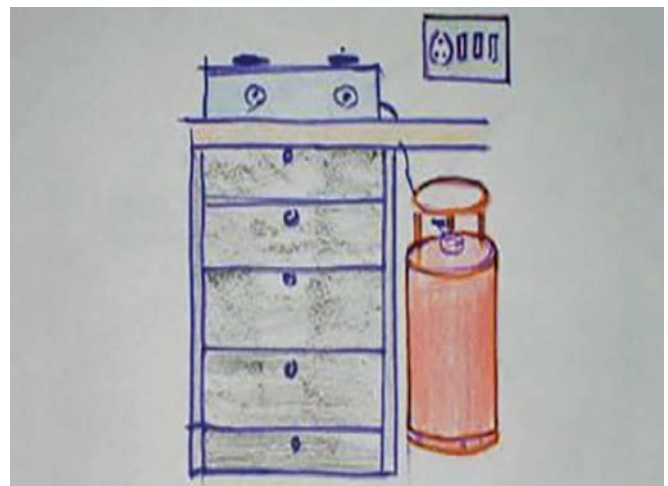


Fig. 23: Gas cylinder close to switch

- Avoid bending over the flame to put out fire.
- Avoid keeping stove/candle/electrical plug near gas cylinder (Fig. 23).
- Avoid open plug point.
- Avoid carrying hot things while children are around.
- Avoid open bathrooms if immersion rod is used to heat water (Fig. 19).
- Avoid keeping mosquito coil near the bed.

SMOKING

- Do not smoke in bed (Fig. 17).
- Do not throw lighted matches/cigarette buds carelessly.
- Do not smoke near flammable liquid or gases.

TREATMENT

Flame Burns

Remove the victim from the site of fire.

- Pour water to cool the burning process (Fig. 24).



Fig. 24: Pour water

- Do not allow them to run as this adds oxygen to fire and increases the flame.
- Flames are either put out by water or smothered by rolling on the ground.



Fig. 25: Electrical burns with immersion coil



Fig. 26: Car radiator burns

Scald Burns

Hot water, milk, tea, oil spilling accidentally are the common causes of burns in Indian kitchen. Hot liquid burns are very common in children and is due to knocking of hot liquid onto them or by stumbling onto a burning agent.

- How to avoid—keep children away from the kitchen, and avoid using tablecloth.
- Treatment—Soaked clothes should be immediately removed and cold water poured over the injured areas. Apply ointments like Neosporin.

Acid Burns

These burns result in laboratories and at home. They cause deep thickness burns. Immediate first aid is given by removing the clothes and diluting with copious amount of water at least for 20 to 30 minutes to wash off the chemicals. Take the patient to the hospital immediately.

Electrical Burns

Caution must be exercised by the rescuer so that he/she does not become a part of the electrical circuit in attempting to free a person still in contact with a live wire (Fig. 25).

- Use dry wood and push the patient away from current source.
- Keep the electric wire away from the child as they may bite the live wire.
- Take the patient to a hospital.

Burns due to Fire Crackers

- Causes serious injury to the eyes, face, and hand.
- Fireworks during festivals should be performed in the presence of adults.

Car Fire

- Engine burning? Turn off ignition.

- Do not pour water on an empty hot car radiator (Fig. 26). Wait to cool or keep face away from radiator while pouring water.

General Measures

Once the patient is burnt, take following measures:

- Put off the fire
- Remove clothes
- Wrap in dry cloth
- Take the patient to hospital (please note speed is not necessary in burns).

Prevention

- Burn prevention is the best burn care, burn injuries are physically and emotionally devastating and a financial nightmare for families and hospitals, and since most of the burns can be prevented, it is our responsibility to inform the community about burn prevention.
- Burn prevention, though not easy, is being designed to increase awareness of burn dangers and it is hoped that these efforts will reduce the incidence and severity.
- A burn injury can happen to anyone, so the best thing is to prevent the injury. Second, it takes only a moment for a tragic accident to occur, but the effect lasts a lifetime. So, take care of yourself and those you love by being burn aware.

TEN COMMANDMENTS OF BURN MANAGEMENT

Acute burn care requires meticulous planning and attention to details. Often, small things escape attention and result in avoidable mortality and morbidity. Care of burn victim can be significantly improved if certain principles are adhered to. It has been proposed as "The

Ten Commandments" of burn care.¹ It is believed that these commandments will help and guide the young surgeon treating burns in far and remote corners of this vast continent.

The ten commandments are

1. To maintain circulation and blood pressure (shock management)
2. To maintain airway
3. To increase body resistance
4. To avoid bacterial toxemia
5. To avoid autotoxemia
6. To watch for renal complications and multiple organ dysfunctions

7. To maintain nutrition
8. To abide by principles of biomechanical physiotherapy and rehabilitation
9. To attend to psychological, emotional aspects, and counseling
10. To analyze factors for reducing mortality.

Strict adherence to these principles and commandments can help to decrease the morbidity and mortality in these unfortunate set of patients.

REFERENCE

1. Gupta JL. Ten commandments in burn management. Indian J Burns 2012;20(1):7-10.