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Review Article

# Review on skin burn along with its treatment

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## A B S T R A C T

Burn care is a very important medical concern. A weakened physical barrier function of the skin can lead to an infection because it exposes the body to microbial invasion. The process of healing damage from burn injuries, endocrine system irregularities, and the onset of an elevated metabolism with subsequent nutrient delivery are all hampered by the increased excretion of water as well as nutrients.

Additionally, the body produces additional oxidative stress when inflammation as well as free radical activities are initiated. These processes can be largely prevented by maintaining enough levels of antioxidants as well as minerals in the body.

As more information from studies and clinical experience is gained, the treatment of patients with thermal damage becomes increasingly successful. Furthermore, burn injuries can present unique issues that require lifetime rehabilitation or late intervention.

In addition to improving patient safety and assistance, research on treating burn wounds has led to advances that will continue to improve functional recovery. This article reviews recent advancements in the medical care of burn victims, with a focus on the physiological characteristics and management of burn wounds.

**Keywords:** Burns, Wound healing, Pathophysiology, Complications, and medicalcare

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## INTRODUCTION

The biggest part in the human organism, with a total area of 2 m2, is the skin together with its appendages, which include hair, nails, and certain glands (Hughes, 2001). 15% of an adult's total body weight is made up of their skin.

The skin is made up of multiple layers. Keratinocytes make up the majority of the epidermis. The basement membrane, sometimes referred to as the dermo-epidermal junction, is a thin, multilayered tissue that sits beneath the epidermis and serves as an anchor. Fat makes up the majority of the hypodermis, the layer that lies beneath the dermis.[1]

Three Layers of Skin-

### 1) Epidermis-

The outermost layer of skin, known as the epidermis, is characterized as a squamous epithelium with stratification, mostly made up of keratinocytes in different stages of differentiation. [2]

Cells of the Epidermis

- Keratinocytes
- Melanocytes
- Langerhans' cells
- Merkel's cell

### 2) Dermis-

The epidermis (1–5 mm) is significantly thinner than the dermis, which makes up the skin's inner layer. The main function of the dermis, which is located between the subcutaneous layer and the basement membrane zone, is to support and maintain the epidermis.[3]

**Papillary layer**: composed of loose connecting tissue that joins the epidermis.

**Reticular layer**: Less cellular made up of dense connective tissue and bundles of collagen fibers.

### 3) Hypodermis-

Often known as subcutaneous fascia, the skin's deepest layer. It has some skin appendages (hair follicles), sensory neurons, blood vessels, and adipose lobules.[4]It acts as the skin's primary structural support, protecting the body from the cold and facilitating the body's ability to absorb shock.

### Functions-

- Provides a protective barrier against mechanical, thermal and physical injury and hazardous substances.
- Prevents loss of moisture.
- Reduces harmful effects of UV radiation.
- Acts as a sensory organ (touch, detects temperature).
- Helps regulate temperature.
- An immune organ to detect infections etc.

## SKIN BURN

Definition- A damage to the skin or other organic tissue that is predominantly brought on by heat, radiation, radioactivity, electricity, friction, or chemical contact is known as a burn.

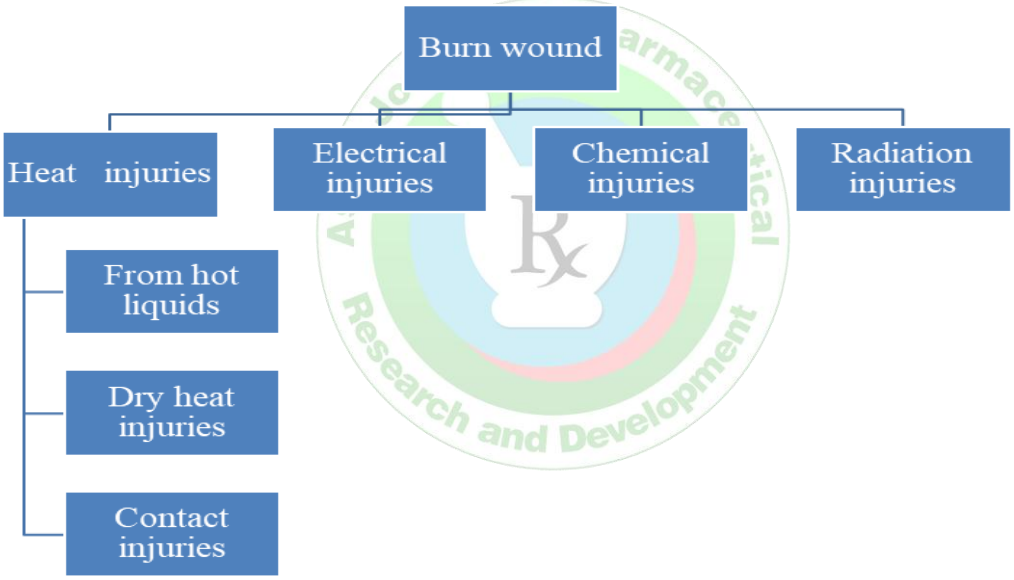
One kind of injury that can be brought on by friction, heat, ice, electricity, chemicals, radiation, or any of these things is called burn trauma. Burn injuries vary widely with regard to of the tissue they damage, how severe they are, and any consequences that may arise. Damage to muscle, bone, vascular, dermal, and epidermal cells can all result in pain.[6]

## EPIDEMIOLOGY-

In US, 450,000 burn patients receive treatment annually. Burns are a major global public health issue that cause an estimated 180,000 fatalities a year. Fire(43%), burns (34%), exposure to hot surfaces (9%), voltage (4%), and chemical exposure (3%), are the most frequent etiologies requiring admission to a burn center.[8]

Every year, more than a million people in India suffer mild to severe burns.[5].

## CLASSIFICATION OF BURNS-




### Types of skin burn[7,9,11]

**Table 1:** Description of degree of burn wound depth

| Degree/Depth | Aetiology | Layer of skin involved | Appearance | Healing time |
|---|---|---|---|---|
| Superficial | Sunexposure, hotliquids with low viscosity | Epidermis only | Pink to red, moist, no blisters | 3–7 days |
| Superficial partial | Hot liquids, chemical burns with weak acid | Superficial dermis | Red, blisters, Moist | 1–3 weeks, long-term pigment changes may occur |
| Deep partial | Flame, chemical, Electrical, hot liquids with high viscosity | Deeper layer(reticular) dermis | Dry, white, non blanching | 3–6 weeks, with scars |
| Deep | Flame,electrical, chemical,blast, self-immolation | Full thickness of skin and into the subcutaneous fat | Leathery, dry, white with thrombosed vessels. | Does not heal by primary intension, Require skin graft |

## PATHOPHYSIOLOGY

**Localised effects-**

Burn injury results in coagulative necrosis of several layers of skin and underlying tissues. Because the major function of the skin is to protect underlying tissues, it usually stops damage from migrating to deeper layers. However, the degree of damage varies depending on the temperature.[15] It has following types-

**a) Zone of coagulation-**

This is the region where necrosis and irreversible tissue damage occurred at the time of the injury. It generally thought to consist of devitalized tissue.

**b) Zone of Stasis-**

This surrounds the region of coagulation zone, is severely harmed by vascular transudate, strong vasoconstricting agents, and localized inflammatory responses. The result is inadequate tissue perfusion. The healing zone may progress towards necrosis or remain healed, contingent upon the surrounding wound conditions.

**c) Zone of Hyperemia-**

a state in which arterial dilatation is brought on by inflammation. One of its distinguishing features is an increased blood flow to healthy tissues; necrosis is uncommon unless there is severe sepsis or prolonged hypoperfusion.[14]

**2) Systemic effects-**

Burns that take up more than 30% of the total surface area of the body cause significant hypovolemia in addition to the production and discharge of inflammatory mediators.Burn shock is characterized by insufficient oxygen and nutrition supply due to inadequate tissue perfusion, as well as a failure to eliminate metabolic waste from the tissues. [12,13]

The rate at which tissue water content increases plays a significant role in the formation of post-burn oedema, and this rate is directly impacted by the kind and volume of fluid resuscitation that the patient receives. During the first hour, the tissue's water content doubles, with ninety percent of the rise occurring in the initial few seconds.Further extravasation is aided by the application of fluid resuscitation, which is influenced by elevated blood flow and capillary pressure brought on by the administered fluids. But if fluids are not provided, oedema usually resolves on its own.[17]

Many systems of organs are involved, with a focus on the circulatory system, which results in hemodynamic changes, the respiratory system, which causes increased breathing effort or rates, the endocrine system, which causes hypermetabolism and high blood sugar levels states, and the immune system, which changes in frequency and function.[16]

### Common causes-[10]

### Inflammatory Response-

An extensive inflammatory reaction is triggered by burns. Following a serious burn, the body experiences a systemic rise in inflammation, accompanied by an increase in circulating cytokines such interferon gamma (INF-γ) and tumour necrosis factor (TNF-α). A disorder known as systemic inflammatory reaction syndrome (SIRS) occurs when there is an imbalance in the cellular environment, which causes the immune system to become overactive. Following a burn injury, the SIRS criteria-an increase in heart rate, a rise in body temperature and respiration rate, and a spike in circulatory white blood cellsare frequently observed.[20]

### Common Symptoms-

1. Blisters that are either intact (unbroken) or have ruptured and are leaking fluid.
2. Pain -- How much pain you have is unrelated to the level of burn.
3. Peeling skin.
4. 4. Shock -- Watch for pale and clammy skin, weakness, blue lips and fingernails, and a decrease in alertness.
5. Swelling.
6. Red, white, or charred skin.

**Table 2:** Types of Injuries

| Types of injuries | Causes |
|---|---|
| Thermal injury | hot solids,hot gases, steam,and electrical heating |
| Radiation injury | infrared heatingsunburn |
| Chemical injury | acidic or basic chemicals |

### Risk Factors-

**Socioeconomic factors**

People living in low- and middle-income countries are at higher risk for burns than people living in high-income countries. Within all countries however, burn risk correlates with socioeconomic status [18]

**Additional risk factors**

- Jobs that put workers at risk for fires.
- Poverty, overcrowding, and a lack of safety precautions.
- Assigning young girls to domestic tasks like cooking and child care.
- Underlying medical conditions, such as epileptic seizures, peripheral nerve damage, and physical and mental impairments.
- Alcoholism and smoking.

- Easy access to chemicals that can be used as weapons (like in acid attacks).
- Using kerosene (paraffin) as fuel for non-electric household appliances.
- Inadequate safety precautions for electricity and liquefied petroleum gas [18]

## Complications-

### 1) Local complications-

burn infections-

Infection of the burn wound is a significant cause of death and complications in burn patients, especially in circumstances of conflict and tragedy. As an undamaged human skin surface is essential for maintaining body fluid equilibrium, thermal regulation. Additionally, sepsis due to catheter-related infections, pneumonia, and suppurative thrombophlebitis is a risk for burn patients. The demographics of the patients, the extent of the burns, and modifications to burn wound therapy are a few of the variables influencing the overall mortality results from burn infections in wounds. [19]

### 2) Systemic Issues-

Systemic problems will develop as a result of the body's extensive inflammatory reaction to the burned area. Reactive oxygen species, also known as ROS, are produced in large quantities after a burn.

**a) burn shock-**

When the organs and tissues of the body are deprived of enough oxygenated blood, shock from burns is a medical emergency that results in hypovolemia, increased vascular resistance, decreased cardiac output, and hypoperfusion after severe burn injuries.

### 3) Breathing complications-

Airway blockage, changes in local blood flow and perfusion, direct cellular damage, and the production of pro-inflammatory cytokines and toxins are the main causes of respiratory problems, especially those resulting from inhalation injuries. This may decrease alveolar macrophages and impair mucociliary clearance, which puts the patient at risk of bacterial infections, particularly pneumonia. [21]

### 4) Orthopaedic complications –

**a) Soft Tissue Damage-**

left hand's untreated extensor tendon injury after burn can cause serious soft tissue damage, such as lesions to the peripheral nerves and tendons, which can have long-term effects if ignored.

**b) Fractures-**

such as lengthy bone fractures, spine cracks, or joint dislocations (often posterior shoulder dislocations), typically occur after falls brought on by the electrical shock. External fixation has long been the accepted standard treatment for treating fractures related to burns. According to more recent evidence, the internal fixing of the orthopaedic injury within the first 48 hours of damage. [22]

**5) Gastrointestinal complications-**

These consist of bacterial translocation, Curling's ulcer, and paralytic ileus. In an effort to maintain endocrine balance and body weight, early enteral feeding frequently reduces difficulties. [19]

## TREATMENT-

**First Aid-**

In order to minimize thermal damage, stopping the burning process is the most crucial stage. This is applying tepid water to the burn for less than 20 minutes, ideally at a temperature of 15C. By taking these steps, the burn's final size and depth may be decreased. Burnt areas might be wrapped during hospital transport as a pain reliever and to stop further fluid loss. Cling film is a highly effective medium for achieving this objective, given its accessibility and near-pathogen-free nature. [11]

**Do's –**

- Take off your clothes, irrigate the burns, and put an end to the burning.
- Put out flames by letting the patient roll around on the ground, covering them with a blanket, or applying water or other liquids that put out fires.
- To cool the burn down, run some cold water over it.
- When dealing with chemical burns, irrigate the area extensively with water

**Don'ts-**

- Before administering first aid, make sure you are safe (turn off the electricity, put on gloves).
- Never cover a burn with paste, oil, haldi (turmeric), or raw cotton.
- Ice should not be applied since it exacerbates the injury.
- Avoid using water to cool yourself down for too long as this can cause hypothermia

## Strategies for clinical care-

**1) Cooling of burn area-**

According to research, the burn victim benefits from prompt removal of the burn's origin and chilling of the affected area. Improving the burned tissue's higher temperature enhances the body's reaction. Crucially, it offers palliative comfort as well. It is important to apply the cooling agent as soon as possible, but it also needs to be at the proper temperature. By lowering blood flow to the wounded area, extreme cold (such as ice) can exacerbate the damage (cold-induced vasoconstriction). Hypothermia is likely to occur when a sizable area of skin is cooled over an extended length of time. Frostbite is another possibility when dealing with cold surfaces. The literature that is currently accessible states that the ideal heat for cooling a wound is 10-20degree **(23)**.

**2) Airflow**

Especially in cases of thermal lung damage, ventilator support and airway treatment are frequently necessary in conditions of severe burns.

**3)Types of Dressings available-**

**a) Active hydrogels dressing-**They are highly hydrophilic macromolecular networks that can be classified as natural or manufactured based on the type of polymer utilized. They are perfect for include high sensitivity to the physiological surroundings, the water level in soft tissues, and sufficient flexibility. These dressings serve a variety of purposes, including covering and cooling wounds, applying to almost any part of the body. **(25)**

**b) Honey-Based Dressings-**Since ancient times, honey is thick syrup high in carbohydrates has been utilized in traditional medicine. fructose, sugar, and fructooligosaccharides make up the majority of its composition. The primary components of natural honey include flavonoids (such as apigenin, pinocembrin, kaempferol, quercetin, galanin), phenolic acids (such as ellagic, caffeine, p-coumaric, and ferulic acids), ascorbic acid, tocopherols, catalase (CAT) have its antimicrobial, antiparasitic, and analgesic. **(24)**

**Medication using pharmacology-**In the immediate aftermath of an injury, burn patients may get opioids for pain control, with morphine typically serving as the first line of treatment. Methadone, ketamine, dexmedetomidine, clonidine, and other opioids have also been frequently administered together in patients who have severe pain during procedures. When administering the alpha 2-agonists dexmedetomidine and clozapine. However, because opioid-induced hyperalgesia is a common adverse effect, the number of opioids administered should be reduced.

**Other agents-**

1. Povidone-iodine
2. Dakin's solution
3. Silver sulfadiazine
4. Mafenide acetate

## Transdermal patches available[26,27]

**Table 3:** Transdermal patches available in market

| Patch | Content | Use |
|---|---|---|
| Hexagel and Aloe vera patch | Aloe vera,deionized water | relieves minor burns and blisters |
| Collagen sheet | Collagen, hyaluronic acid, alginate, chitosan, elastin and cmc | proliferation and healing |
| Centella extract loaded patch | Centella extract,aloe vera | Wound healing |

## CONCLUSION

In conclusion, our in-depth examination of skin burns and their treatment reveals understanding of strategies involved. First categorizing burns accurately, distinguish between first, second and third-degree burns guides appropriate treatment pathways.

Further it accentuates the pivotal role of first aid measures. the effectiveness of cooling burns with water. this also emphasize fire safety, proper handling of hot objects. creating awareness becomes key component in reducing the incidence of skin burns.

Our report underscores efficacy of treatments, advanced wound dressings and regenerative therapies. These accelerate the healing process and long-term complications. Patient education plays a key role, empowering to actively participate in healing process.

In essence, the findings emphasize patient centric approach to burn management. The collaboration between interventions, innovative treatment, psychological support and patient education collectively shapes strategy to address challenges associated with skin burn. let us collectively commit to prioritize safety practices, reducing incidents of burns and promoting healthier community.

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