Burns : Types, Classification, Symptoms and Treatment

Burns are injuries to the skin and underlying tissues caused by thermal, chemical, electrical, radiation, or mechanical agents. The injury leads to **protein denaturation** , increased **vascular permeability** , loss of intravascular fluids, and edema.

Etiology of Burns

- **Thermal:** Flame, hot liquids, steam
- **Chemical:** Acids, alkalis, vesicants
- **Electrical:** Low voltage (<1000V), high voltage (>1000V), lightning
- **Mechanical:** Friction burns
- **Radiation:** UV light, ionizing radiation
- **Frostbite:** Cold-induced tissue injury

Persons at Risk

1. **Extremes of age:** Children <4 years, elderly >50 years
2. **Impaired protective ability:** Alcoholics, diabetics, paraplegics, psychiatric patients, convulsives
3. **Environmental hazards:** Unsafe storage of petrol, paraffin use, smoking in bed, working near electric wires
4. **Innocent bystanders:** Accidental exposure

Skin Anatomy & Function

Layer	Description & Components	Function
Epidermis	Outermost layer; stratified epithelium. Contains: - Stratum corneum (dead, cornified cells) - Malpighian layers (germinal basal cells, stratum spinosum & granulosum)	Barrier to microbes, toxins; retains water & electrolytes Cell renewal via Malpighian layers
Dermis	Dense connective tissue with collagen, elastic fibers, blood vessels, nerves Divided into papillary (superficial) and reticular (deeper) dermis	Structural support; blood supply; thermoregulation; sensation
Subcutaneous tissue	Areolar and adipose tissue, skin appendages, variable thickness	Insulation, cushioning, fat storage

Functions of the Skin

- Protect against microorganisms
- Shield from UV radiation
- Vitamin D synthesis
- Thermoregulation and water retention
- Cosmetic function & identity (fingerprints)

Pathophysiology of Burns

- Tissue injury ? release of **vasoactive substances** (prostaglandins, histamine, leukotrienes, oxygen radicals) ?
- **Increased capillary permeability** ? fluid shifts ? **edema** , **hypovolemia** , decreased cardiac output ? **shock**
- Compensatory mechanisms: sympathetic stimulation ? tachycardia, vasoconstriction ? reduced skin, muscle, gut perfusion
- Severe burns: **myocardial depression** (due to TNF-alpha), **hemolysis** , **acute renal injury** (from hypoperfusion or myoglobinuria)
- Pulmonary complications from bronchoconstriction mediated by histamine, serotonin
- Increased evaporative water loss ? **dehydration** and **hypothermia**

Classification of Burns

1. **According to Cause**

Type	Features, Examples & Management
Thermal	Flames, hot liquids (>45°C), steam. Most common cause.
Chemical	- **Acids:** Coagulative necrosis; superficial damage; burning stops early; flush with water for 1-2 hours. - **Alkalis:** Liquefactive necrosis; deep damage; prolonged reaction; flush extensively; do NOT neutralize. - Extravasation injuries from drugs (cytotoxics, potassium, bismuth) cause tissue necrosis; stop infusion & dress locally.
Electrical	Low (<1000 V), high (>1000 V), very high voltage (lightning). Cause entry/exit wounds, deep tissue damage, arrhythmias, rhabdomyolysis ? myoglobinuria ? renal failure.
Frostbite	Cold-induced tissue freezing injury.
Mechanical	Friction burns from skin scraping against rough surfaces.
Radiation	UV light, ionizing radiation causing cellular damage.

2. **According to Depth**

Degree	Tissue Involved	Appearance	Clinical Features	Healing & Scarring
1st degree	Epidermis only	Red, dry, painful, no blisters	Tender, hypersensitive	Heals in days, no scarring
2nd degree (superficial)	Epidermis + upper 1/3 dermis	Red, moist, blistered	Very painful	Heals in 2-3 weeks, minimal scarring
2nd degree (deep)	Epidermis + deeper dermis (lower 2/3)	Pale, dry, less painful	Reduced sensation	Longer healing, hypertrophic scars possible
3rd degree	Full thickness (epidermis + dermis)	White, leathery, dry, insensate	No pain (nerve destruction)	Requires grafting, scars inevitable
4th degree	Full thickness + underlying tissues (muscle, bone)	Charred, black	No sensation	Amputation often required

Additional Notes on Specific Types

Chemical Burns

- **Acids:** Cause coagulation necrosis ? limits depth.
- **Alkalis:** Cause liquefactive necrosis ? deeper and more severe damage.

Electrical Burns

- May cause **compartment syndrome** ? may require fasciotomy.
- **Fluid resuscitation** guided by urine output; monitor for myoglobinuria (dark urine).
- Arrhythmias may occur; ECG monitoring mandatory.

Management Principles

- **Stop the burning process** : Remove patient from source; remove contaminated clothes.
- **Fluid resuscitation** : Guided by burn extent and urine output (Parkland formula for thermal burns, adjust for electrical burns).
- **Pain control:** Analgesics (opioids as needed).
- **Wound care:** Clean, sterile dressings; debridement when indicated.
- **Prevent infection:** Topical antimicrobials; tetanus prophylaxis.
- **Supportive care:** Maintain thermoregulation, nutrition, and monitor for complications.
- **Surgical:** Skin grafting for deep burns; fasciotomy if compartment syndrome suspected.