

# BURNS

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# DEFINITION

A burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals



# TYPES OF BURNS

- 1) **Contact burns:** There is physical contact between the body and a hot object, like heated solid or molten metal
- 2) **Flame burns:** There is actual contact of body with flame. It may produce vesication, singeing of the hair and blackening of the skin.

-Flash burns are a variant of flame burns which are due to initial ignition from flash fires (sudden ignition or explosion of gases or petrochemicals). It burns the exposed surfaces to the flash, and not the folds of skin and other protected areas.





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3) Radiant heat burns: They are caused by heat waves, a type of electromagnetic wave. There is no contact between the body and flame or hot surface.

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4) Ionizing radiation burns (X-rays, radium, UV rays): It can be localized or may involve the whole body depending on radiation exposure

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5) Chemical burns: Classified into acids, alkalis and vesicants (blister forming). Characteristically, there are ulcerated patches, no blisters, hair is not singed and the red line of demarcation is absent



# 6) SCALD BURN

- A scald is a form of thermal injury which results from application of liquid  $> 60^{\circ}\text{C}$  or from steam and involves only the superficial layers of skin.

## Types

- 1) Immersion burns: Accidental or deliberate immersion in hot liquid, usually water.
- 2) Splash or spill burns: Usually accidental.
- 3) Steam burns: Exposure to superheated steam.





- Hot water accounts for most of the immersion or splash burns.
- scald show sharp demarcation with tickle marks, soddening and bleaching, but do not singe the hair or blacken/char the skin.





# MEDICO-LEGAL ASPECTS

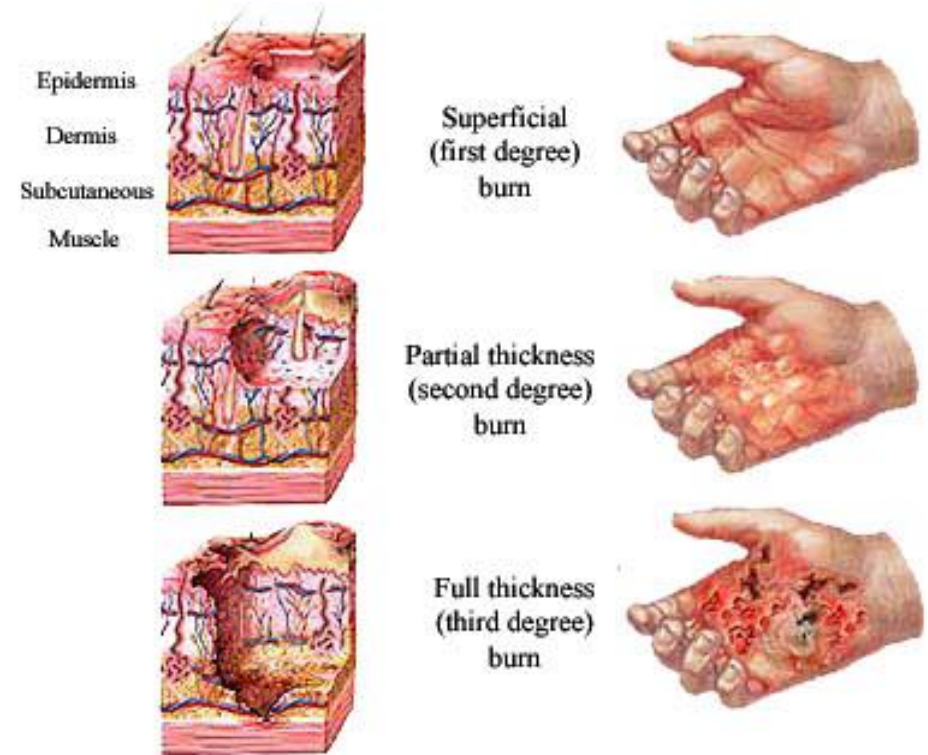


- It is usually accidental due to splashing or pouring of fluid during cooking
- Accidents are common in children and in the elderly.
- Boiling water may be thrown intentionally, usually domestic homicide intent with the husband being the victim.
- Deliberate scalding by hot water is common form of child abuse



# CLASSIFICATION

- Clinically, burns are classified as first degree (superficial) burns, second degree (partial and deep partial) burns and third degree (full thickness) burns





**Table 1. Classification of Burns by Depth**

<b>Burn Thickness</b>	<b>Deepest Skin Structure Involved</b>	<b>Appearance</b>	<b>Pain</b>	<b>Prognosis (Without Surgical Intervention)</b>
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](http://www.ebmedicine.net).



# EFFECT OF BURNS

Effects will depend upon factors like:

1) Degree of heat applied: Effects are severe, if heat applied is very great.

2) Duration of exposure: More prolonged the exposure, more severe will be the effect as burning of human skin is temperature and time dependent. Indication of burn depth comes from history.

3) Assessing the size (extent of body surface affected): The total body surface area (TBSA) involved is usually worked out by the Wallace Rule of Nines

-When burn surface involves 1/3rd of body surface area or more (usually 30–50%), the result is nearly always fatal.



# EFFECT OF BURNS

4)Site: Burns of head and neck, chest and abdomen, especially anterior abdominal wall including genitals and perineum, even when superficial are more dangerous than deep burns involving the extremities or back.

5)Age: Children < 2 years and elderly (> 60 years) are more susceptible (> 20% surface area involvement carries poor prognosis)

6)Gender: Women are more susceptible

7)History of natural disease or concomitant trauma, electrical injury or inhalation injury also results in poor outcome





**CAUSE OF DEATH  
IMMEDIATE & DELAYED**



- Immediate causes
- 1) Primary or neurogenic shock: Due to pain or fright.
- 2) Asphyxia: Suffocation may result from inhalation of CO, CO<sub>2</sub>, or cyanide or falling of the building on the body during attempt to escape. CO poisoning is an important cause in most fire deaths (COHb > 50% is confirmatory).
- 3) Smoke- or heat-induced laryngospasm, respiratory arrest, and/or a vagal reflex-caused cardiac arrest are other proposed mechanisms of rapid death



## Delayed causes

1) Hypovolemic, burns or secondary shock: More than half of the deaths occur due to secondary shock within 24–48 h due to loss of fluid and protein, causing decrease in cardiac output and multiorgan failure.

2) Acute edema of glottis occurs from inhalation of irritant smoke or hot gases with or without pulmonary edema. Respiratory failure (inhalation injury, pneumonia or ARDS) is also a significant cause of death within 3 days

3) Toxemia due to absorption of toxic products from the burnt surface. Death occurs in about 3–4 days

4) Sepsis: Most important cause of death, occurring in 4–5 days or longer after burn. Septicemia can be caused by burn wound infections

5) Infective complications: Bronchitis, bronchopneumonia, enteritis

Sequelae of burns: Scars, keloid, Marjolin's ulcer, Curling's ulcer, corneal capacity, obliteration of external auditory meatus, joint deformity or ankylosis can occur.





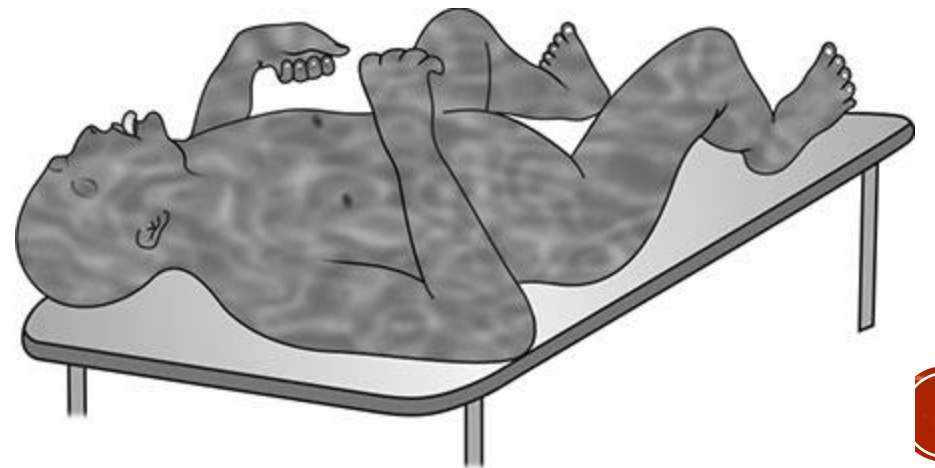
# AUTOPSY

- **External findings :**
- - **Clothing** should be carefully removed and examined for presence of kerosene, petrol or any other inflammable substance.
- - **Site, distribution and extent** of burning are recorded. Distribution is important in the analysis of whether the burns are appropriate for the position in which the body was found.
- - **Face:** Usually distorted and swollen, protruding tongue, pink froth.
- - **Skin:** Owing to the effect of heat on blood, the veins spasmed and congested , giving a marbled appearance.
- - **Degloving/destocking** may be seen due to cuticular peeling





- cherry pink staining indicate CO poisoning.
- Kerosine oil gives a characteristic odor and sooty blackening of parts.
- **Pugilistic attitude (boxing, fencing or defense attitude): It is due to heat stiffening .**  
**Cause: Due to coagulation of proteins of muscles and dehydration which causes contraction.**







**Heat ruptures:** These are splits occurring in the skin due to contraction of the heated and coagulated tissue, and the resultant breaches may simulate incised or lacerated wounds. It is usually seen over the **area of severe burning, over fleshy areas, like calves and thighs, and over extensor surfaces and joints.**





## Differentiation 14.2: Heat rupture and lacerated wound

<i>S.No.</i>	<i>Feature</i>	<i>Heat rupture</i>	<i>Lacerated wound</i>
1.	Cause	Exposure to heat	Blunt force
2.	Site	Fatty tissue	Anywhere
3.	Vessels and nerves	Intact	Torn
4.	Bruising around the margins	Absent	Present





# INTERNAL FINDINGS

## -Heat hematoma:

simulate extradural\ epidural hematoma.

Cause: The blood may come from the longitudinal venous sinuses or the diploic veins. The heat may force blood out of the marrow of the calvarium through veins and out over the surface of the dura.

Differentiation 14.3: Epidural hematoma (EDH) due to burns and blunt force			
S.No.	Feature	EDH due to burns	EDH due to blunt force
1.	Cause	Charring of the skull due to intense heat	Blunt force to the head
2.	Situation	Anywhere	Usually adjacent to Sylvian fissure
3.	Position	Usually bilateral	Usually unilateral
4.	Distribution	Diffuse	Localized
5.	Characteristics	Evenly distributed or sickle-shaped; honeycomb appearance; soft, granular, foamy, friable clot; chocolate brown in color (pink, if CO is present) <sup>33</sup>	Disc shaped; uniform, smooth, rubbery; reddish-purple color
6.	Skull fracture	Eggshell fracture—elliptical or circular defect without radiating fracture lines, seen above the temple	Fracture line radiating from a skull defect present in temporal area
7.	Crossing of suture lines	It may cross suture lines and overlie the frontal, parietal and temporal area	Hematoma do not cross sutures as the dura is anchored at the suture lines
8.	Injury to CNS	Absent	May be present



- **Brain:** Congested, and appears swollen with widening and flattening of the gyri and obliteration of the sulci due to the contraction of the coagulating
- **Neck:** Hemorrhage in the root of the tongue and neck muscles—considered vital reactions in burn victims
- **Larynx, trachea and bronchioles:** Contain carbon and soot particles, and the mucosa is congested with frothy mucus secretions. **This is the surest sign of antemortem burns, which is due to inhalation of gases.**
- **Pleura and lungs:** Congested and inflamed with serous effusion.
- **Heart:** Chamber full of blood, cherry red in color due inhalation of CO.
- Spleen, liver, kidneys, adrenals .





# ANTEMORTEM AND POSTMORTEM NATURE OF BURNS

- PRESENCE OF SMOKE IN THE AIR PASSAGES
- EVIDENCE OF THERMAL INJURY OF THE RESPIRATORY TRACT BY FUMES/HOT GASES
- ELEVATED BLOOD CARBOXYHAEMOGLOBIN LEVELS
- PRESENCE OF OTHER TOXIC GASES IN THE BLOOD
- CUTANEOUS REACTION TO HEAT AND FLAME
- Presence of Vital Reaction (Red Flare/Red Line)
- Vesication (Blisters)



Features	Antemortem burns	Postmortem burns
Line of redness	Most often present around the injured burn area	Not so
Vesicles	Contain serous fluid with high proportion of albumen and chlorides. Base of the blister is red and inflamed	Contain air mostly; if any fluid present, it comprises of very little albumen, no chlorides. Base of the blister is dull, dry, hard and yellow
Evidence of inflammation	Inflammatory oedema with signs of repairative and repair processes (depending upon the survival period—leucocytic infiltration has been reported to occur at 6 hours)	No such evidence of reaction is ever noticed
Presence of carbonaceous deposits/soot in the respiratory tract	Indicative of death from suffocation following antemortem burns	Not present
Presence of carboxyhaemoglobin in blood	When present with other features of antemortem burns, it is highly suggestive and diagnostic (it has been reported that there is no significant difference in the blood carboxyhaemoglobin levels drawn from peripheral versus heart sites)	It will be absent since artificial elevation of carboxyhaemoglobin saturation level in a dead person simply by being in or near a fire is unlikely as the gas cannot diffuse through the skin or otherwise be absorbed by a dead body
Enzymatic activity	Increased enzyme reaction in the periphery of antemortem burn (it is time-related, viz.: tissue cathepsin—immediate, leucine aminopeptidase—2 hr, acid phosphatase—3 hr, nonspecific esterase—3/4 hr and alkaline phosphatase—4 hr)	No such activity/reaction will ever be noticed

