

Burns: Forensic Examination of a Charred Body

Forensic Medicine - Exam-Oriented Notes

1. Introduction

In a charred body with alleged history of burns, the main forensic question is whether the person was:

1. **Alive when burnt - ante-mortem burns**
2. **Burnt after death - postmortem burning**
3. **Burnt to conceal homicide, identity or other injuries**

Final opinion should be given after correlating:

Scene examination + autopsy findings + toxicology + COHb estimation + circumstantial evidence.

2. Classification of Burns According to Wilson

Wilson classified burns into **three types** according to **depth of tissue damage**.

A. Epidermal Burns

Also called **first degree burns**.

Features:

1. Involves only **epidermis**
2. Produces **erythema / redness**
3. Area is **painful**
4. Usually heals without scar

B. Dermo-Epidermal Burns

Also called **second degree burns**.

Features:

1. Involves **epidermis and dermis**
2. Produces **vesication / blister formation**
3. Area is **very painful**
4. Hair follicles, sweat glands and sebaceous glands may be involved

C. Deep Burns

Also called **third degree burns**.

Features:

1. Involves full thickness of skin and deeper tissues
2. May involve **deep fascia, muscles, vessels, nerves and bones**
3. Produces **charring**
4. Area may be relatively **painless** due to destruction of nerve endings

3. Forensic Examination in a Charred Body

A. Scene Examination

1. Photograph the body and scene before disturbance.
2. Note whether body is found at **actual place of fire** or shifted.
3. Look for smell of **kerosene, petrol or accelerant**.
4. Look for **matchbox, stove, lamp, gas cylinder, kerosene can**.

5. Examine condition of **doors, windows and furniture**.
6. Look for evidence of **struggle, blood stains, drag marks or restraint**.
7. Preserve **clothes, burnt articles and suspected accelerant samples**.
8. Note position of body and presence of **pugilistic attitude**.
9. Check whether scene is consistent with **accidental, suicidal or homicidal burning**.

B. Identification

In a charred body, identity may be established by:

1. **Clothing and personal belongings**
2. **Jewellery**
3. **Dental examination**
4. **Bones**
5. **Sex organs**, such as uterus or prostate if preserved
6. **DNA profiling** from bone or teeth
7. Fingerprints, if skin is preserved

4. Postmortem Findings of Ante-Mortem Burns

A. External Findings

1. Line of Redness

A **line of redness** may be seen around the burnt area.

Importance:

1. It is a **vital reaction**
2. It indicates the person was **alive when burnt**
3. It is absent in postmortem burns

2. True Burns Blisters / Vesicles

Ante-mortem blisters show:

1. **Serous fluid**
2. Fluid rich in **albumin and chlorides**
3. **Red, inflamed base**
4. **Erythematous areola**
5. Swelling around blister

These are due to **vital inflammatory reaction**.

3. Crow's Feet Sign

Crow's feet sign means spared wrinkles at the outer angles of eyes.

Cause:

The victim tightly closes the eyes due to **heat and smoke irritation**, so the skin folds near the eyes are spared.

Importance:

It suggests the person was **alive during fire**.

4. Soot on Body

Soot may be present on:

1. Face

2. Nose
3. Mouth
4. Clothes
5. Exposed body parts

Soot on the body alone does **not prove ante-mortem burning**.

5. Singeing of Hair

Scalp hair, eyebrows, eyelashes and body hair may be:

1. Singed
2. Burnt
3. Clubbed

But singeing of hair can occur in **ante-mortem or postmortem burning**.

6. Degloving

Skin of hands or feet may peel off in **glove and stocking manner**.

It helps sometimes in identification, but it is **not a sure sign of ante-mortem burns**.

7. Pugilistic Attitude

The body may show **pugilistic attitude** due to heat stiffening of muscles.

It does **not indicate struggle**.

B. Internal Findings

The important internal signs are remembered as **3 Cs**.

1. Carbon / Soot Particles in Respiratory Tract

Presence of **carbon or soot particles in the respiratory tract** is a very important sign of **ante-mortem burning**.

Soot may be seen in:

1. Nose
2. Mouth
3. Larynx
4. Trachea
5. Bronchi
6. Smaller bronchioles

Importance:

If soot is present deep in the air passages, it indicates the person was **breathing during the fire**.

Therefore, it is one of the **best signs of ante-mortem burns**.

2. Carboxyhaemoglobin in Blood

Inhalation of carbon monoxide forms **carboxyhaemoglobin / COHb**.

Findings:

1. Blood may appear **cherry red**
2. Muscles and organs may show **cherry red colour**
3. Raised COHb supports **ante-mortem inhalation of smoke**

Important:

Low or absent COHb does not completely exclude ante-mortem burning, because death may be rapid or fire may occur in open air.

3. Curling's Ulcers

Curling's ulcers are acute stress ulcers seen in:

1. **Stomach**
2. **Duodenum**, especially first part

They occur due to stress and shock following burns.

Other Internal Findings

1. **Congestion of lungs**
2. **Pulmonary oedema**
3. **Soot-stained mucus** in air passages
4. **Congestion of liver, spleen, kidneys and brain**
5. **Fat embolism** may be seen in lungs
6. Evidence of other injuries such as **head injury, strangulation or stab wounds** should be looked for

5. Difference Between Ante-Mortem Burns and Postmortem Burns

Feature	Ante-Mortem Burns	Postmortem Burns
Line of redness	Present	Absent
Vital reaction	Present	Absent
Blisters	True blisters with albumin and chloride-rich fluid	False blisters with air/gas or thin fluid
Base of blister	Red, inflamed and swollen	Dry, hard, pale yellow
Inflammatory areola	Present	Absent
Soot in respiratory tract	Present deep in air passages	Absent
COHb in blood	Raised if smoke inhaled	Absent or insignificant
Cherry red colour	May be present	Absent
Crow's feet sign	May be present	Absent
Healing / granulation	Present in old burns	Absent
Pugilistic attitude	May be present	May be present
Heat rupture	May be present	May be present
Other fatal injuries	May or may not be present	May indicate homicide before burning

6. Pugilistic Attitude

Definition

Pugilistic attitude is the posture of a burnt body resembling a boxer.

It is also called:

1. **Boxing attitude**
2. **Fencing attitude**

Features

1. Arms are flexed at **elbows**
2. Forearms are flexed
3. Fingers are flexed like claws
4. Legs are flexed at **hips and knees**

5. Body appears as if in a defensive posture

Mechanism

It is due to **heat stiffening**.

Heat causes:

1. **Coagulation of muscle proteins**
2. **Dehydration of muscles**
3. **Contraction of muscles**

Since **flexor muscles are stronger than extensors**, the body assumes flexed posture.

Medico-Legal Importance

1. It is a **postmortem heat artefact**
2. It can occur whether the person was **alive or dead**
3. It does **not prove struggle**
4. It does **not differentiate ante-mortem and postmortem burns**

7. Heat Rupture

Definition

Heat ruptures are splits in skin and subcutaneous tissue produced by intense heat.

Mechanism

They occur due to:

1. Drying of skin
2. Shrinkage of tissues
3. Splitting over tense areas

Sites

Common sites:

1. **Extensor surfaces**
2. **Joints**
3. **Thighs**
4. **Calves**
5. Other fleshy areas

Medico-Legal Importance

Heat ruptures may resemble:

1. **Incised wounds**
2. **Lacerated wounds**

Difference from True Wounds

Heat rupture shows:

1. **No vital reaction**
2. **No tissue bruising**
3. **No extravasation of blood**
4. **No clotted blood in tissues**
5. Blood vessels and nerves may be seen **bridging the gap**

6. Margins are dry and burnt

8. Heat Haematoma

Definition

Heat haematoma is a postmortem collection of blood in the **extradural space** due to exposure of skull to intense heat.

Mechanism

Heat causes:

1. Boiling of blood in cranial vessels
2. Expansion of steam and gases
3. Rupture of vessels
4. Collection of altered blood between skull and dura

Appearance

Heat haematoma is:

1. **Soft**
2. **Friable**
3. **Chocolate brown**
4. **Spongy / honeycomb appearance**
5. May be **sickle-shaped**

Difference from Traumatic Extradural Haematoma

Feature	Heat Haematoma	Traumatic Extradural Haematoma
Cause	Heat artefact	Head injury
Colour	Chocolate brown	Dark red clot
Consistency	Soft, friable, spongy	Firm, rubbery clot
Shape	Sickle-shaped / irregular	Lens-shaped
Associated injury	Charred skull, heat fractures	Skull fracture and brain injury
Vital reaction	Absent	Present

9. Rule of Nine

The **Wallace Rule of Nine** is used to estimate **percentage of total body surface area burnt** in adults.

It is useful for:

1. Assessing **severity**
2. Estimating **prognosis**
3. Planning **fluid therapy**
4. Medico-legal documentation

Adult Rule of Nine

Region	Percentage
Head and neck	9%
Right upper limb	9%
Left upper limb	9%
Anterior trunk	18%
Posterior trunk	18%
Right lower limb	18%
Left lower limb	18%
Perineum / genitalia	1%
Total	100%

Simple Diagram

FRONT	BACK
Head & Neck 9%	Head & Neck 9%
RUL 9% Trunk 18% LUL 9%	RUL 9% Back 18% LUL 9%
Right LL 18%	Left LL 18%
Left LL 18%	Right LL 18%
Perineum 1%	

Easy writing method:

Head & neck = 9%
 Each upper limb = 9% + 9%
 Front trunk = 18%
 Back trunk = 18%
 Each lower limb = 18% + 18%
 Perineum = 1%
 Total = 100%

Note: In children, **Lund and Browder chart** is preferred because body proportions are different.

10. Difference Between Burns and Scalds

Feature	Burns	Scalds
Agent	Dry heat	Moist heat
Examples	Flame, hot solid, radiant heat	Hot water, steam, hot liquid
Clothes	Burnt, scorched or charred	Wet and sodden, not burnt
Hair	Singeing present	Singeing absent
Charring	May be present	Absent
Skin	Dry, blackened or charred	Pale, sodden, bleached
Spread	May spread upwards with flame	Flows downwards by gravity
Splash marks	Usually absent	Present
Blisters	Often at margins	May be over affected area
Scars	Thick, contracture common	Thin scars, contracture less common

11. Causes of Death in Burns

A. Immediate Causes

1. **Neurogenic shock** due to pain and fright
2. **Asphyxia**
3. **Carbon monoxide poisoning**
4. **Cyanide poisoning** from smoke
5. **Smoke inhalation**
6. **Laryngeal oedema**
7. **Glottic oedema**
8. **Laryngeal spasm**
9. **Cardiac arrest**

B. Early Causes

Usually within **24-48 hours**:

1. **Hypovolaemic shock**
2. **Plasma loss**
3. **Fluid and electrolyte imbalance**
4. **Pulmonary oedema**
5. **Acute respiratory distress**
6. **Acute renal failure**

C. Delayed Causes

After **48 hours**:

1. **Septicaemia**
2. **Toxaemia**
3. **Bronchopneumonia**
4. **Acute renal failure**
5. **Curling's ulcer bleeding**
6. **Multi-organ failure**

Important: **Septicaemia** is a common cause of death in persons who survive the initial period.

12. Medico-Legal Importance of Burns

1. To Decide Ante-Mortem or Postmortem Burning

Important signs of ante-mortem burning:

1. **Soot in respiratory tract**
2. **Raised COHb**
3. **Line of redness**
4. **True blisters**
5. **Vital reaction**
6. **Crow's feet sign**

2. Concealment of Homicide

A body may be burnt after death to hide:

-
1. Identity
 2. Cause of death
 3. Injuries
 4. Evidence of murder
 5. Sexual assault

Therefore, autopsy must look for:

1. Head injury
2. Strangulation
3. Stab wounds
4. Poisoning
5. Defence injuries
6. Restraint marks

3. Dowry Death / Bride Burning

Burns in married women may be related to **dowry death**.

Important current legal points:

1. Dowry death - BNS Section 80
2. Cruelty by husband or relatives - BNS Section 85
3. Cruelty defined - BNS Section 86
4. Presumption as to dowry death - BSA Section 118

4. Suicidal Burns

Common method:

1. Pouring **kerosene**
2. Ignition by matchstick or flame

Common in:

1. Persons with psychiatric illness
2. Domestic disputes
3. Dowry harassment situations

5. Accidental Burns

Common in:

1. Children
2. Elderly persons
3. Epileptics
4. Intoxicated persons
5. Domestic kitchen accidents
6. Occupational accidents

6. Homicidal Burns

Homicidal burns may occur by:

1. Pouring kerosene or petrol
2. Setting victim on fire
3. Burning after killing to destroy evidence

Suspicious features:

1. Absence of soot in respiratory tract
2. Low or absent COHb
3. Other fatal injuries
4. Signs of struggle
5. Restraint marks
6. Scene inconsistent with accident or suicide

7. Grievous Hurt

Burn injuries may amount to **grievous hurt** if they cause:

1. Permanent disfiguration of head or face
2. Endanger life
3. Severe bodily pain or inability to follow ordinary pursuits for **15 days**
4. Other criteria of **BNS Section 116**

If caused voluntarily by fire or heated substance, relevant provision is **BNS Section 118**.

8. Identification

In charred bodies, identification is important and may require:

1. Dental examination
2. DNA
3. Bones
4. Jewellery
5. Clothing
6. Sex organs
7. Personal belongings

13. Opinion in the Given Case

A charred body with alleged burns and allegation of burning after death should be examined carefully.

Findings favouring **ante-mortem burns**:

1. Soot in respiratory tract
2. Raised carboxyhaemoglobin
3. Line of redness
4. True blisters
5. Red inflamed blister base
6. Crow's feet sign
7. Evidence that victim inhaled smoke

Findings favouring **postmortem burning**:

1. No soot in respiratory tract
2. No significant COHb
3. No vital reaction
4. False blisters
5. Other fatal injuries
6. Burning appears done to destroy evidence

Therefore, final opinion should be given after:

Autopsy + COHb estimation + toxicology + scene examination + investigation of other injuries.

Exam Recall Box

Ante-mortem burns: soot in airway + COHb + line of redness + true blisters.

Postmortem burns: no vital reaction, no airway soot, no COHb.

Pugilistic attitude: heat stiffening, not struggle.

Heat rupture: mimics wound, but **no bleeding/vital reaction**.

Heat haematoma: chocolate-brown, friable, spongy extradural clot.

Rule of Nine: Head **9**, each arm **9**, front trunk **18**, back trunk **18**, each leg **18**, perineum **1**.

Burns vs scalds: dry heat = **singeing/charring**; moist heat = **wet clothes/splash marks**.

Legal: Grievous hurt = **BNS 116**, dowry death = **BNS 80**.