

Injuries by Physical Agents

Burns

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Objectives

- ▶ Students should be able to
- ▶ Identify different types of injuries caused by physical agents
- ▶ Identify different circumstances of burn injuries
- ▶ Identify medico legal issues related to burn injuries
- ▶ Examine and prepare Medico legal report on a burnt patient (clinical appointment)

Injuries according to the causative factors



Mechanical injuries

- Blunt force trauma
- Sharp force trauma

Physical agents

- Thermal
- Chemical
- Electrical
- Lightning
- Radiation

Injuries from physical agents

Physical agents are sources of energy that may cause injury or disease. Examples include noise, vibration, radiation, electricity and extremes in temperature.

Heat injury (burn)

A burn is an injury caused by heat or by a chemical or physical agent having an effect similar to heat

External application of heat affects cellular structure and function.

Heat injuries



Moist heat

- Hot liquids

Dry heat

- Flame
- Radiant heat
- Contact heat
- Electricity
- Lightening

Severity and effects of burns depends on

The temperature of the heat source

Duration for which the heat was applied

Resistance of the body to withstand heat

Extent of body surface area

Area of the body

Age of the victim

Types of burns



Scalds

Dry burns

Corrosive burns



Moist thermal burns /Scalds



- Moist burns are referred to as scalds
- Temperature cools gradually as it disperse
- Point of contact produce maximum damage

Appearance of scalds



- Sudden bleached appearance
- Erythema
- Necrosis of dermis
- Abundant blisters/vesicles

Appearance of scalds



- Mostly over the clothed area
- Splash marks
- Drip marks
- No singeing of hair

Appearance of scalds



- No charring
- Heal without a scar except hot oil, molten metal & tar
- Minimal disfigurement

Circumstances of scalds



**Accidental
children and in elderly**

**Intentional
child abuse, domestic
violence**

**Upper fluid levelel,dribble pattern and splash marks guide for
circumstances**

Burns from dry heat



They are caused by

- flame
- heated objects
- Radiated heat

Circumstances



Mostly accidental
Bottle lamps
Kerosene cookers / LP gas
Alcoholics – Smoking

Suicidal
Kerosene oil

Circumstances



Rarely homicidal
Kerosene or petrol is used

Postmortem disposal

Appearance of dry burns



Singeing of hair.- end of the hair is clubbed



Coagulation of protein & charring

Appearance of dry burns

Heal with scar formation

Associated with contracture & disfigurement

Drip & splashes are absent (may be seen in petroleum products)



Appearance of dry burns



Severity vary from
reddening



to cremation

Appearance of dry burns



Mild burns – red/blisters



**Moderate burns – Stiffened,
yellow/ brown and leathery skin**



**Severe burns – Conversion of the bone
to brittle greyish white splinters ,
absence of limbs**

Appearance of dry burns



Skin discoloured due to
smoke or soot
deposition



Froth, pink stained at the
mouth and nostrils – due
to pulmonary oedema

Appearance of dry burns



Muscle contractures due to dehydration and protein denaturation



This is called 'pugilistic attitude'

Examination of a burnt patient

History

- Date time and place
- Reason for fire
- Circumstances
- How does this person get injuries

Examination of a burnt patient

Distribution of burns

- – diagrams
- – photographs

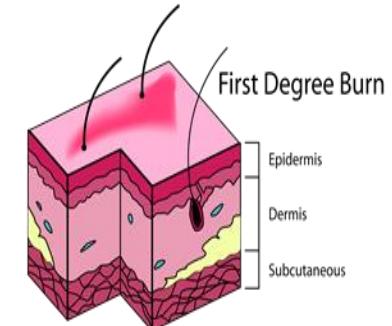
Percentage of burns

Depth of burns

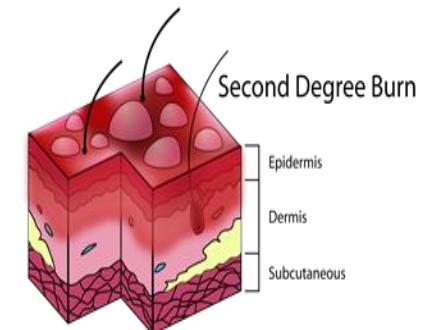
Classification of severity of burns



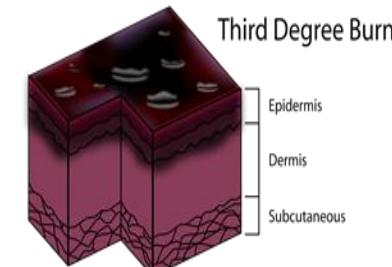
First degree – Erythema and blistering without loss of dermis.



Second degree – full thickness of the dermis is destructed.



Third degree – Destruction of deeper tissue below the skin.

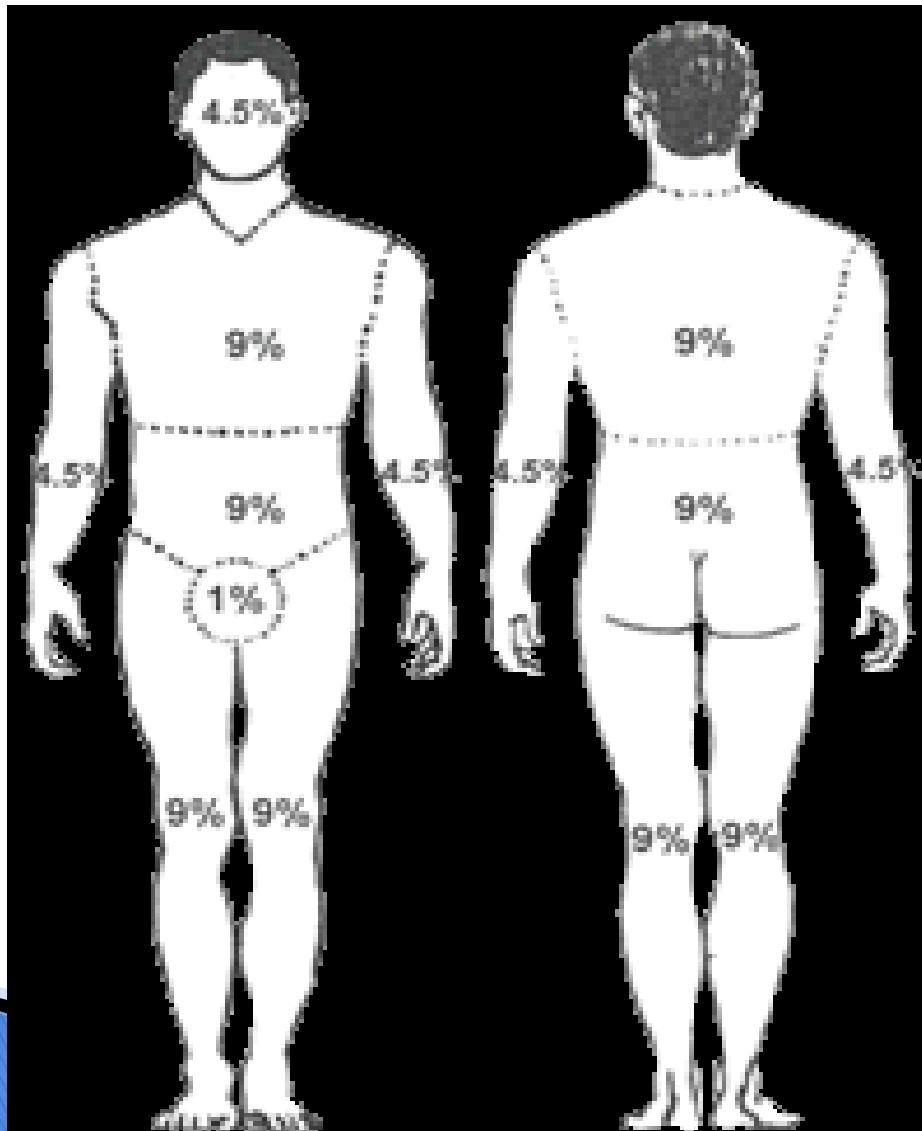


Area of burns

‘rule of nine’ or

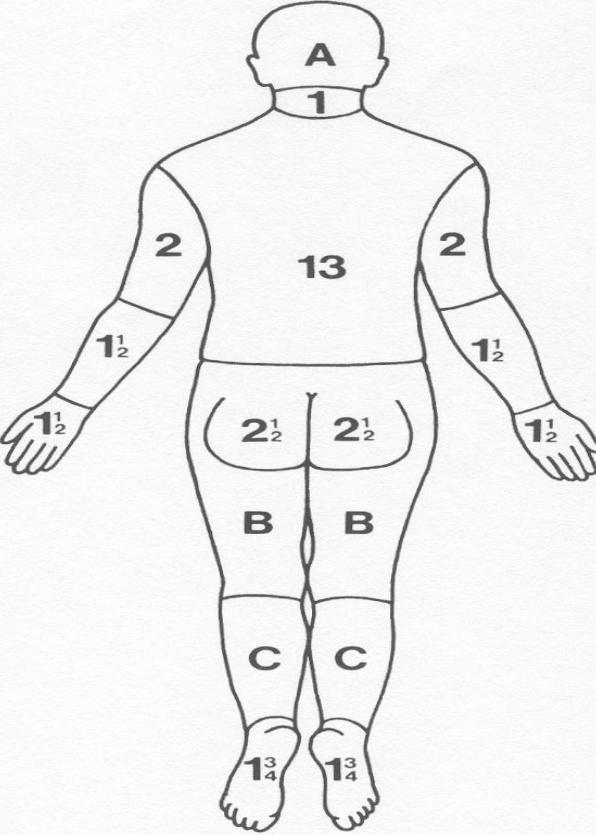
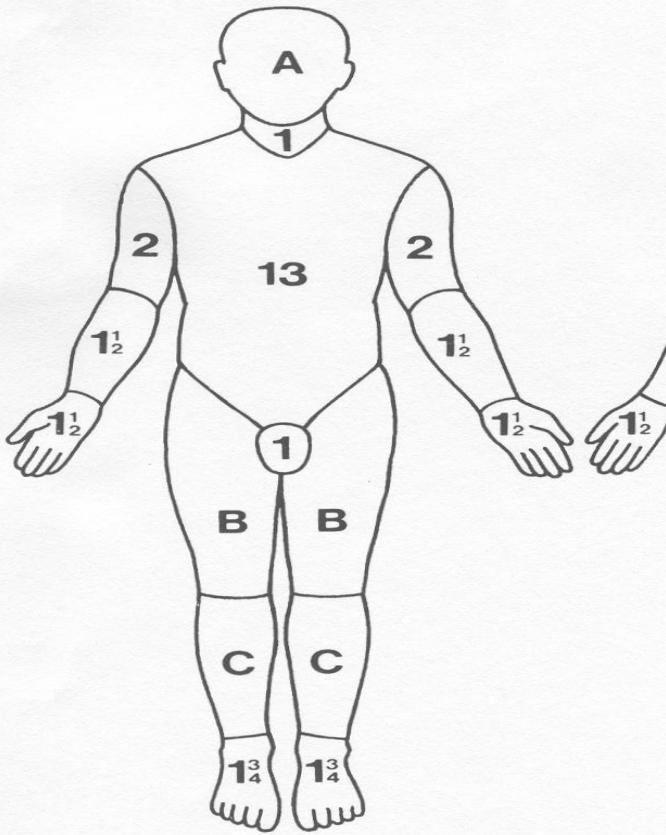
**‘Lund and
Browder’ charts.**

Rule of nine



Lund and Browder

LUND AND BROWDER CHARTS



IGNORE
SIMPLE ERYTHEMA

- Superficial
- Deep

REGION	%
HEAD	
NECK	
ANT. TRUNK	
POST. TRUNK	
RIGHT ARM	
LEFT ARM	
BUTTOCKS	
GENITALIA	
RIGHT LEG	
LEFT LEG	
TOTAL BURN	

RELATIVE PERCENTAGE OF BODY SURFACE AREA
AFFECTED BY GROWTH

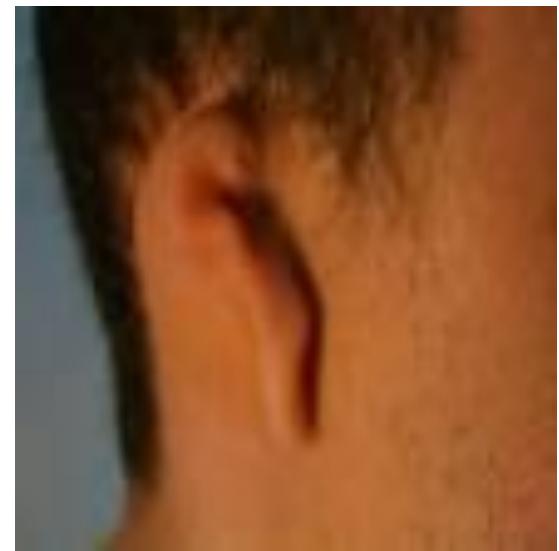
AREA	AGE 0	1	5	10	15	ADULT
A = $\frac{1}{2}$ OF HEAD	9½	8½	6½	5½	4½	3½
B = $\frac{1}{2}$ OF ONE THIGH	2¾	3¼	4	4½	4½	4¾
C = $\frac{1}{2}$ OF ONE LEG	2½	2½	2¾	3	3¼	3½

Injury description



Case

- ▶ 30 year old person sustained accidental burn injuries from a burst boiler while working.
- ▶ He has severe facial scarring with lose of vision in eye, impairment of hearing, contractures at the elbow and wrist.
- ▶ How would you categorize the hurt for MLR?



Category of hurt in burns

Grievous injury	
Limb ‘b’	Lose or impairment of vision
Limb ‘c’	impairment of hearing
Limb ‘e’	impairment of joints
Limb ‘f’	disfigurement of head or face
Limb ‘i’	Not attending ordinary work for 20 days

Category of hurt in burns

35% burns – Endangers life

50% burns – FIOCN

90% burns – Necessary fatal

Prognosis d/o

Degree of burns

Anatomical area involved

Depth of burns

Age of the victim

Treatment given

Death due to burns

Medico-legal issues in death due to burns



Identity of
the person

Medico-legal issues in death due to burns

Was the victim alive or dead at the time of burning?

Cause of death

Time since death

Interpretation of injuries

Circumstances of death

Medico-legal issues in death due to burns



Challengers in interpretation of injuries

- Severely burnt body
- Presence of post mortem burns on top of ante mortem burns

Medico-legal issues in death due to burns

Interpretation of injuries

- Are the burns ante mortem or post mortem ?
- Heat artifacts
- Injuries of intentional violence
- Accidental trauma
- Post mortem injuries
- Loss of injuries



Case

- ▶ Body of a well known foot ball player was found inside a burnt car with injuries.
- ▶ At the autopsy, how would you determine whether the burn injuries are ante mortem or post mortem ?

Interpretation of injuries



- Ante mortem burns
- Presence of vital reaction (broad red margins with erythema)
- Presence of blisters (red base, red margins, filled with fluid rich in proteins, chloride and polymorphs)

Interpretation of injuries



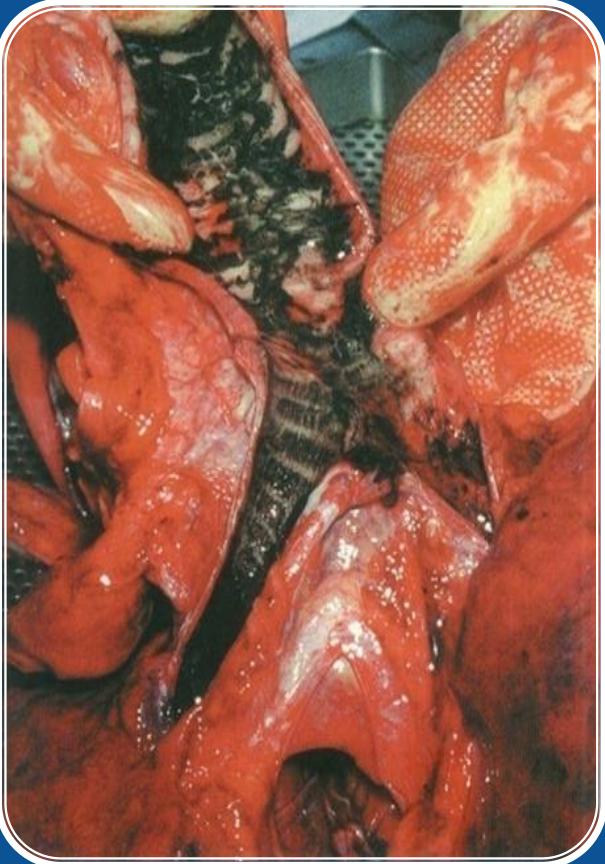
Post Mortem
injuries
pale yellow

Other factors which help in diagnosis of ante mortem burn injuries



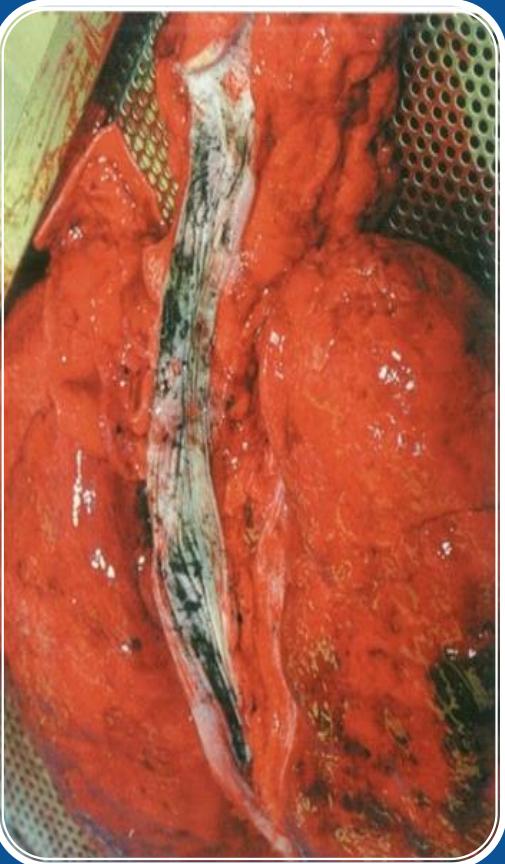
Cherry pink
hypostasis
Pink discolouration
of blood, organs

Other factors which help in diagnosis of ante mortem burn injuries



Soot mixed with mucous found attached to the trachea and bronchi or in lower respiratory passage

Other factors which help in diagnosis of ante mortem burn injuries



Soot particles in
oesophagus and
stomach mixed with
saliva

Investigations which help in diagnosis of ante mortem injuries

Co in the blood > 15%

Cyanide in the blood

Fat embolism in the lung

Histology – soot in the terminal bronchioles, vital reaction in injuries

Heat artifacts



Heat ruptures on extensor
surfaces
mimic lacerations



Heat fractures
linear splitting of bone

Heat artifacts



Heat haematoma

collection of blood in the extra dural space



Bilateral

Friable

chocolate brown

honey comb appearance

Heat artifacts



Contractures – gives pugilistic posture

Accidental trauma by falling masonry

Skin ruptures due to post mortem handling

Loss of injuries

Medico-Legal investigation of death due to burns

History



- Agent which has caused the fire
- Reason for fire
- Circumstances
- If suicide, motivation

Medico-Legal investigation of death due to burns con't.

Scene visit



- Place of maximum burns in the building
- Smell of gasoline
- Inflammable material

Medico-Legal investigation of death due to burns con't.

Identification

- Facial features
- Clothing
- Personal belongings
- Dental data
- DNA



Medico-Legal investigation of death due to burns con't.

Clothing



- Clothed/Partly clothed/Naked
- Extent of burns
- Smell of gasoline

Medico-Legal investigation of death due to burns con't.

external
examination



- Areas & extent of burns

Medico-Legal investigation of death due to burns con't.

Internal examination

- Involved organs & extent of burns
- Natural pathology



Medico-Legal investigation of death due to burns con't.

Lab investigations

- Blood for Co , CN, alcohol, drugs
- Stomach contents
- Histopathology



Causes of death in burns

Neurogenic shock – due to pain

Asphyxia – by laryngeal oedema

Co poisoning

Inhalation of toxic gases

Causes of death in burns

Infection & septicaemia

Acute renal failure

Hypovolaemic shock

Haematemesis – Curlings ulcers

Summary

- ▶ Types of burns
- ▶ Medico legal issues related to burn injuries
- ▶ Features of ante mortem and postmortem burn injuries
- ▶ Investigation of death due to burn injuries

Reference

- ▶ Pathology of trauma ,3rd ed.- Bernard Knight
- ▶ Lecture notes on injuries - Dr L.B.L.de Alwis
- ▶ Simpson's Forensic Medicine,12th ed. - Richard Shephered

- ▶ Acknowledgement
- ▶ Reference books
- ▶ Google images
- ▶ Doctor's who provide photographs to the Departmental collection of photographs

A photograph of a forest fire at night. The scene is dominated by intense orange and yellow flames that engulf the lower half of tall, dark evergreen trees. The fire is most concentrated in the center and right side of the frame, with smaller pockets of light visible on the left. The sky above the trees is a deep orange, suggesting either a sunset or the glow from the fire itself. In the foreground, a dark road or path leads towards the viewer, with some blurred lights from a vehicle visible on the right side.

Thank you