

Asphyxia Part 1

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Asphyxia

- ✓ Greek name means “absence of pulse”
- ✓ It is the condition/death that results due to anoxia or hypoxia.
- ✓ **Asphyxia:** Anything that interferes with oxygen transfer

Asphyxia

Examples of asphyxial deaths (anoxic and hypoxic death):

- Defective oxygenation of blood in lungs (hypoxic hypoxia) or by total failure in oxygenation (anoxic anoxia).

Asphyxia

- Absence or reduction of oxygen tension in external atmosphere such as reduced barometric pressure
- Replacement of oxygen by inert gas, nitrogen, carbon dioxide, or exposure to sewer gas
- Mechanical interference with passage of air into or down respiratory tract

Asphyxia

- Closure of external respiratory orifices : smothering and overlying
- Obstruction of the air passages : drowning, choking by foreign body impaction, throttling, strangulation and hanging
- Restriction of the respiratory movements of the thorax like in Traumatic asphyxia

Asphyxia

- Reduction in ability of the blood to transport oxygen (anaemic hypoxia)
- Decrease in cardiac function will lead to impaired or reduction oxygen delivery (stagnant hypoxia)

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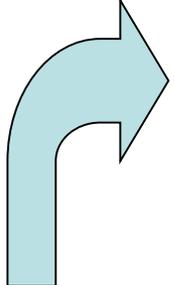
Asphyxia

- Decrease in oxidative process in tissues (histotoxic hypoxia). Eg. Acute carbon monoxide poisoning
- Paralysis of respiratory muscles from brain stem or spinal cord damage
- Curare like drugs

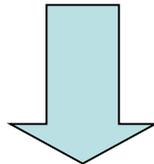
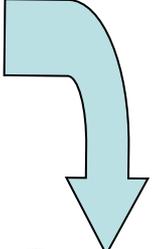
Classic signs of asphyxia

- Cyanosis
- Congestion
- Petechial haemorrhages

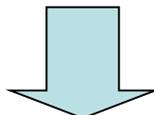
Asphyxia



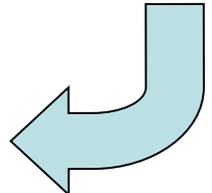
Reduction in O₂ tension



Capillary dilatation

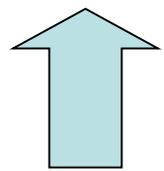


Capillary stasis



Capillary engorgement
Stasis of blood in organs

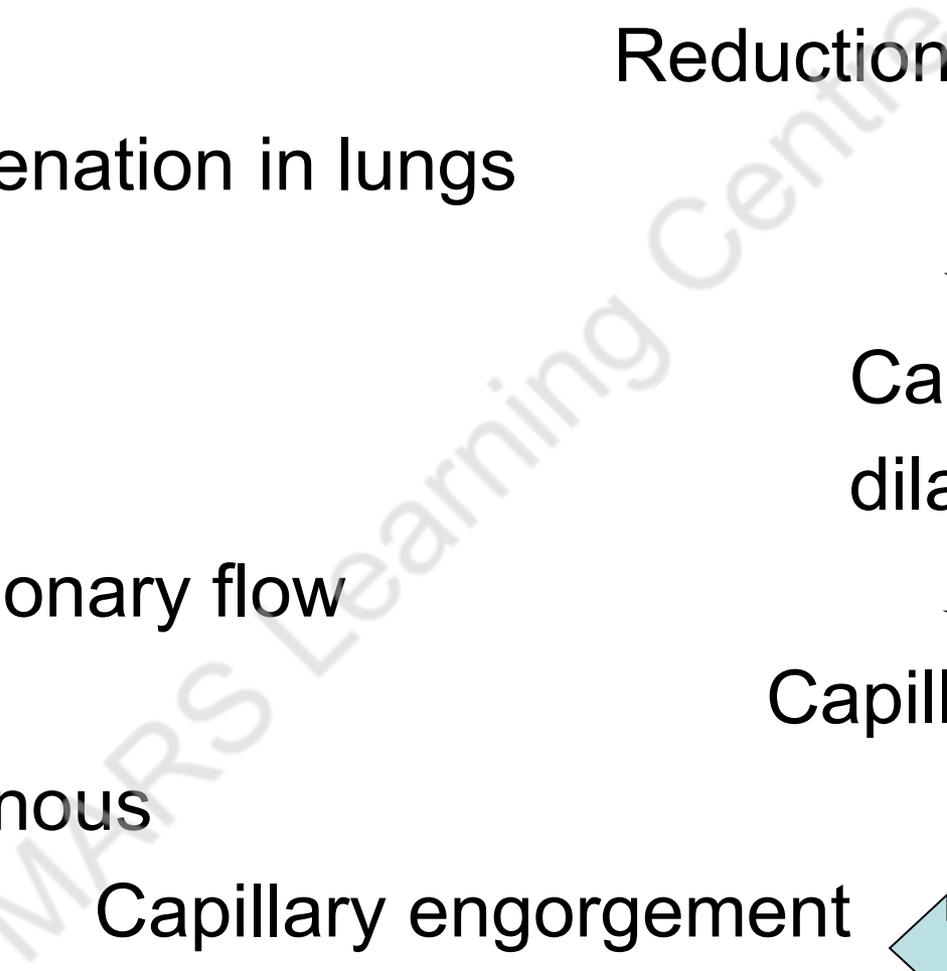
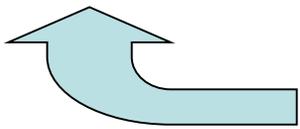
Deficient oxygenation in lungs



Reduced pulmonary flow



Diminished venous
return to heart



Cyanosis

- The word is derived from Greek, meaning “dark blue”.
- It depends on the absolute amount of reduced haemoglobin.

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Cyanosis

- There must be at least 5 gram of reduced Hb per 100 ml blood before cyanosis becomes evident
- Constriction of the neck lead to congestion and cyanosis of the face due to accumulation of venous blood containing much reduced Hb
- In respect of dead, it's difficult to use cyanosis because it will be overshadowed by hypostasis

Congestion

- It is also due to obstructed venous return
- Face, lips and tongue become swollen and reddened in neck compression. By cyanosis the color will be darkened
- Congestion in tongue, pharynx and larynx, above the level of venous obstruction in strangulation

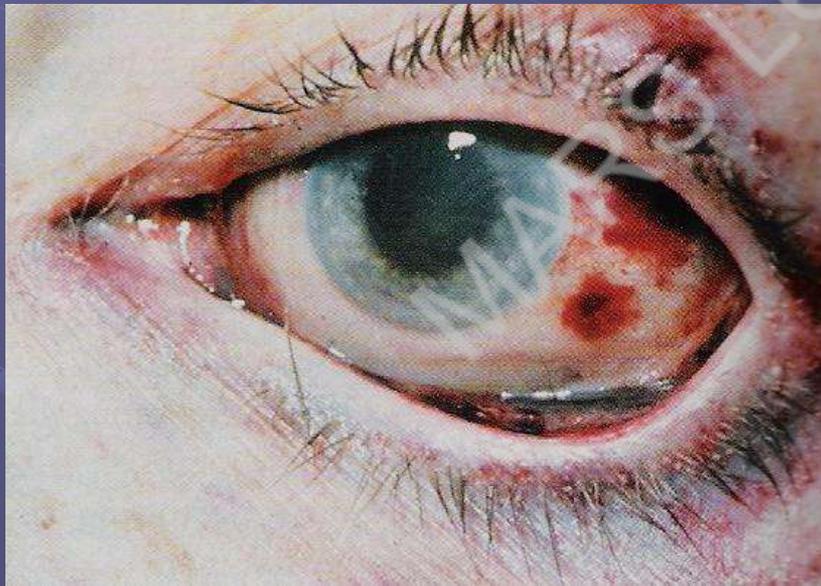
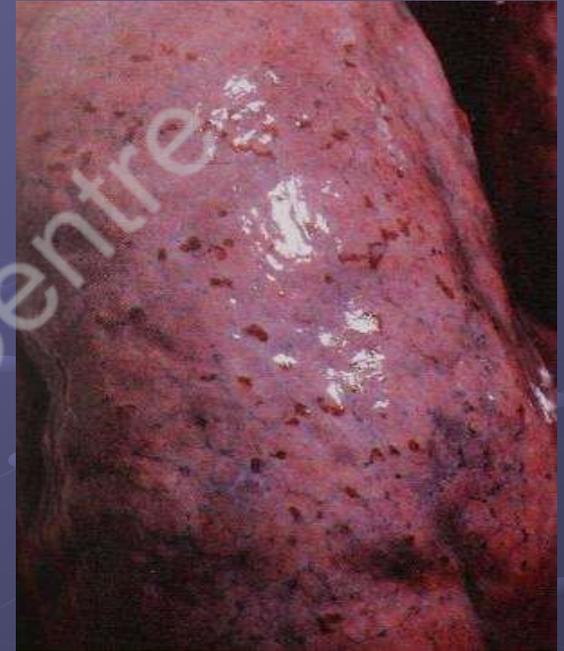
Petechial haemorrhages

- Small pin-point collection of blood lying in skin, sclera or conjunctiva and under thoracic serous membrane of the pleura and pericardium
- They vary in size from a tenth of millimeter to 2 millimeters, if larger it will be ecchymoses
- Due to acute rise in venous pressure lead to over distension and rupture of thin-walled peripheral venules



Figure 13.1 Petechial haemorrhages on the eyelid in a case of manual strangulation.

Petechial Hemorrhages



Petechial haemorrhages

- Victims of compression of the neck the occlusion of jugular veins prevents venous drainage from the head, while the carotids and the vertebral arteries are patent or partially compressed.
- Victims of fixation of the chest : pressure on the chest forces blood back into great veins and, as the venous valves in the subclavian vessels prevents displacement into the arms, the extravolume is forced into valveless jugular system to congest the head and neck.

Petechial haemorrhages

Petechial haemorrhages in the dead body of suspected asphyxial death are seen in following places:

Sclera and conjunctiva, upper eye lids, skin of forehead and the skin behind the ear, face as a whole. Visceral pleura, in interlobular fissures and around the hilum, epicardium and very rare in the white matter of the brain

Suffocation

- It is a reduction of oxygen in the respired atmosphere.

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Suffocation

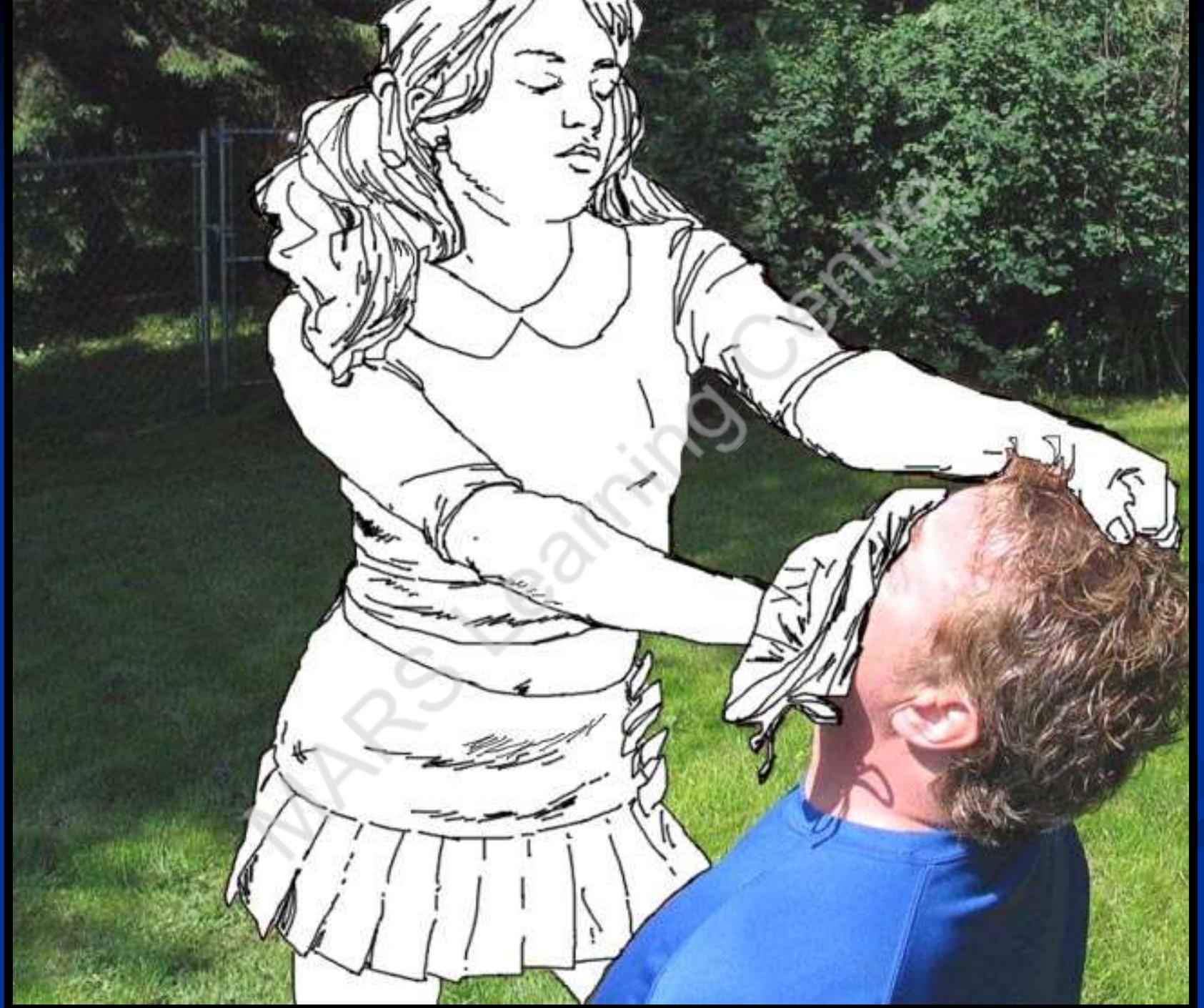
Decrease in atmospheric oxygen may occur in the following :

- Cabine failure of aircraft at high altitudes causes dramatic fall in the partial pressure of the oxygen and hence reduce the penetration of gas through the alveolar wall.
- Reduction of oxygen in atmosphere by physical replacement by other gases, such as combustion.

Smothering

It refers to death from mechanical occlusion of the mouth and nose.

The smothering agent is usually fabric, an impervious sheet or hand, a mobile solid such as sand, mud, grain or flour.



Smothering

Death in Smothering:

- May occur by occluding substance pressing down upon the facial opening
- Or by passive weight of the head pressing the nose and mouth into the occlusion, in the incapacitated persons. e.g. drunkenness, epilepsy, drug overdose
- Homicide is difficult to prove here, and can occur in old, debilitated person, and in infancy where it can also be accidental.

Smothering

- Bruises or abrasion on the cheeks, around the mouth, lips or lesions within the lips or mouth give strong evidence of possible smothering.

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Overlaying of infants

- When an infant was found dead in the morning in the maternal bed, it was assumed that the mother had turned over onto the baby in her sleep and suffocated it.

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Plastic bag suffocations

- It's commonly suicide, but may also be homicidal or accidental.
- Usually in the form of an open-ended bag, usually polythene or other plastic, is placed over the head down to the neck level.
- In homicide usually, the bag will be tied at it's opening with cord or tie.
- The mechanism of death is rapid cardio-inhibitory mode, the face is being pale and congested.

Plastic bag suffocations

- If the bag still in place, search for other indication of suicide, such as drug in blood analysis and futile injuries as slashed wrists.

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Gagging

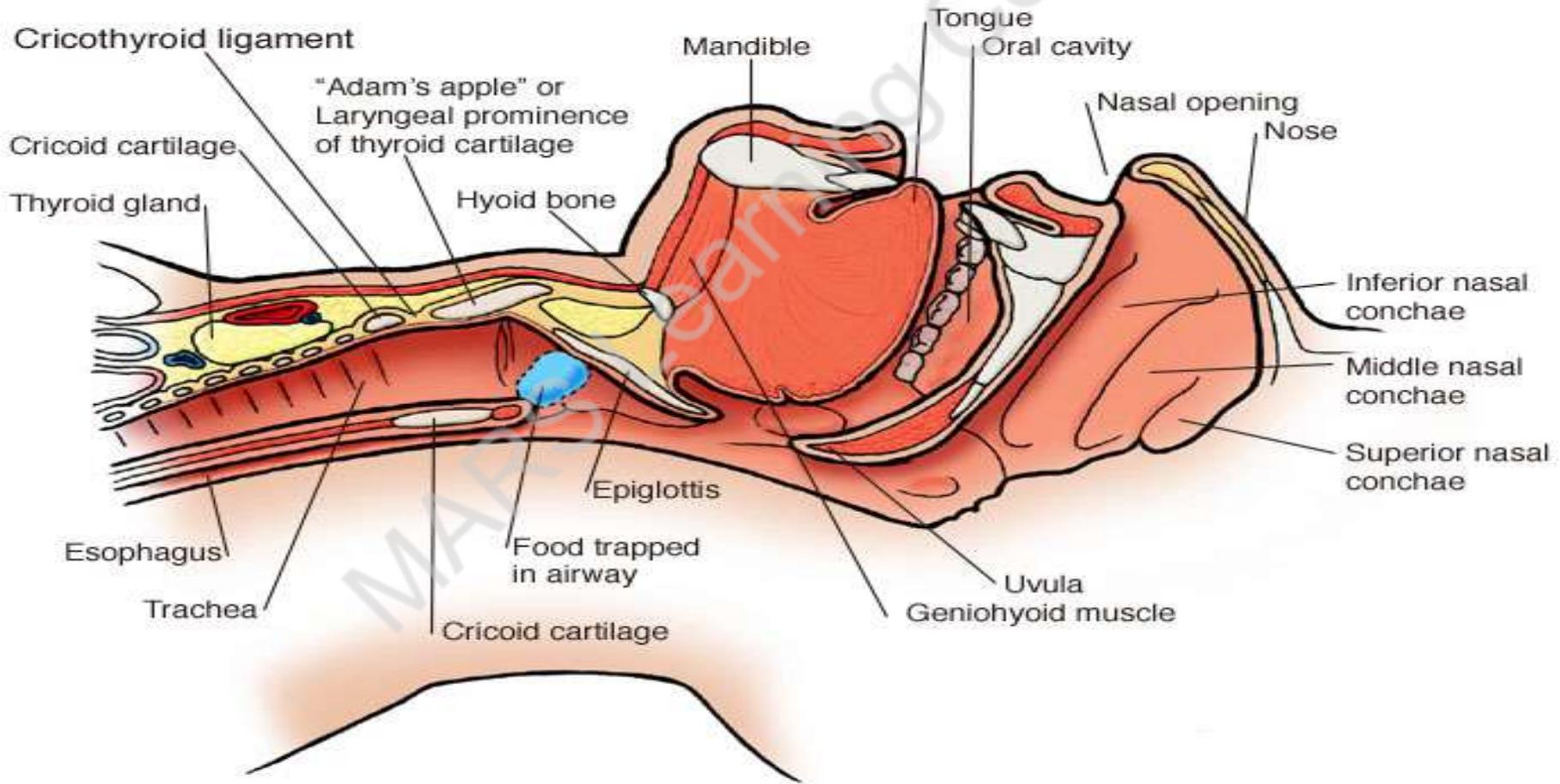
- The air passages may be obstructed when a cloth or soft object is pushed into the mouth, or placed across the mouth.
- Often during robbery when the victim is tied up and the cloth is used to ensure their silence.
- At first breathing can take place via the nose, but as time goes on, nasal mucus and oedema or movement of the gag, will close the nasopharynx and the progressive asphyxia develops.

Choking

- Blockage of internal airways usually between the pharynx and the bifurcation of the trachea. Mechanism of death either hypoxia which may show the classic signs of asphyxia, or neurogenic cardiac arrest

Choking

It is a form of asphyxia caused by impaction of foreign body (Solid object) in the glottis or windpipe





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Figure 13.4 Impaction of food in the larynx – café coronary.



Fig. 14.5 Heimlich manoeuvre

Causes of choking

- Foreign bodies: gags, dummies, small toys ...etc, usually by children and mentally retarded person.
- Dentures & haemorrhage: operation and injuries of nose, ear and thorax.
- Acute obstructive lesions: laryngeal oedema, epiglottitis in children.
- Food material: undigested bolus of food, often steak lodged in pharynx or larynx, death due to vasovagal reflex.

Causes of choking

- Gastric content in the air passages either due to agonal or peri-mortem spillage or can be significant in case of acute alcoholism.
- Definitive evidence of aspiration is, either reliable witness observation during life or gross/histological finding in respiratory system.

Traumatic asphyxia

- It's a mechanical fixation of the chest. It acts by restricting respiratory movement and thus prevents inspiration.
- Chest and abdomen are compressed by unyielding substance or object, so the chest expansion and dia-phragmatic lowering are prevented.
- e.g. burial in sand, victim being trapped under an overturned vehicle.

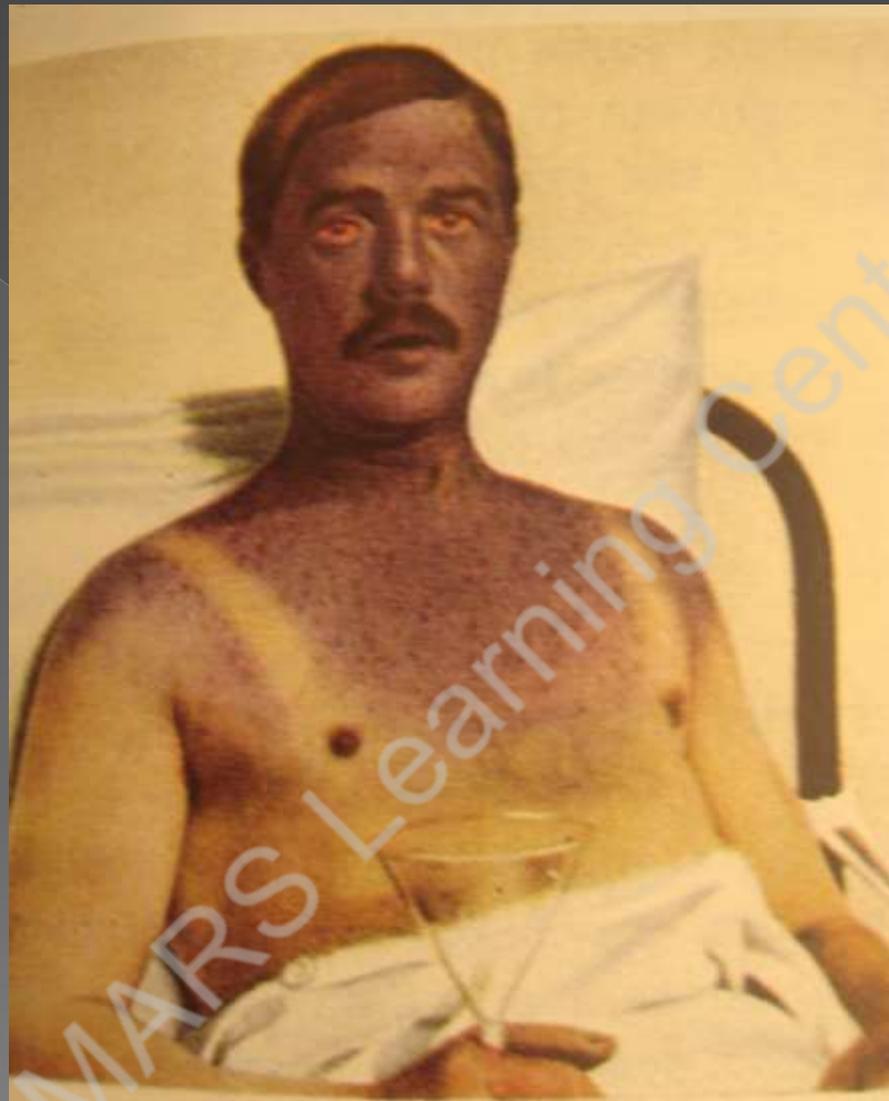


Fig.14.6 Traumatic asphyxia: Intense congestion of face and upper chest



Figure 13.13 Traumatic asphyxia due to pressure on the chest from an overturned tractor. The extensive congestion and petechial haemorrhages in the head and neck are typical of this type of asphyxia.

Traumatic asphyxia

- Crushing in crowds
 - e.g. Mecca stampede
 - Football stadium disasters

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Features of traumatic asphyxia

- Face, neck and shoulder down to the thoracic inlet are discolored “red”.
- It may extend lower than the clavicle to the level of 3rd rib.
- The conjunctiva and sclera may be so engorged with blood.
- Haemorrhagic tissue actually bulges out through the lids, completely obliterating the white of the eye.

Features of traumatic asphyxia

- The face, lips and scalp may be swollen and congested being dotted with petechiae and ecchymoses, with bleeding from the ears and nostrils.
- There may be local bruises or abrasion from the weight of solid object.
- There may be injuries to the chest wall from the trauma of the fixating object.
- Marked distension of right heart and veins

Postural asphyxia

- It occurs when a person is in a certain position for an extended time either due to being trapped, or being in a drunken or drugged state
- There may be mechanical impediment to adequate respiratory movements. May be with impairment of venous return to the heart.

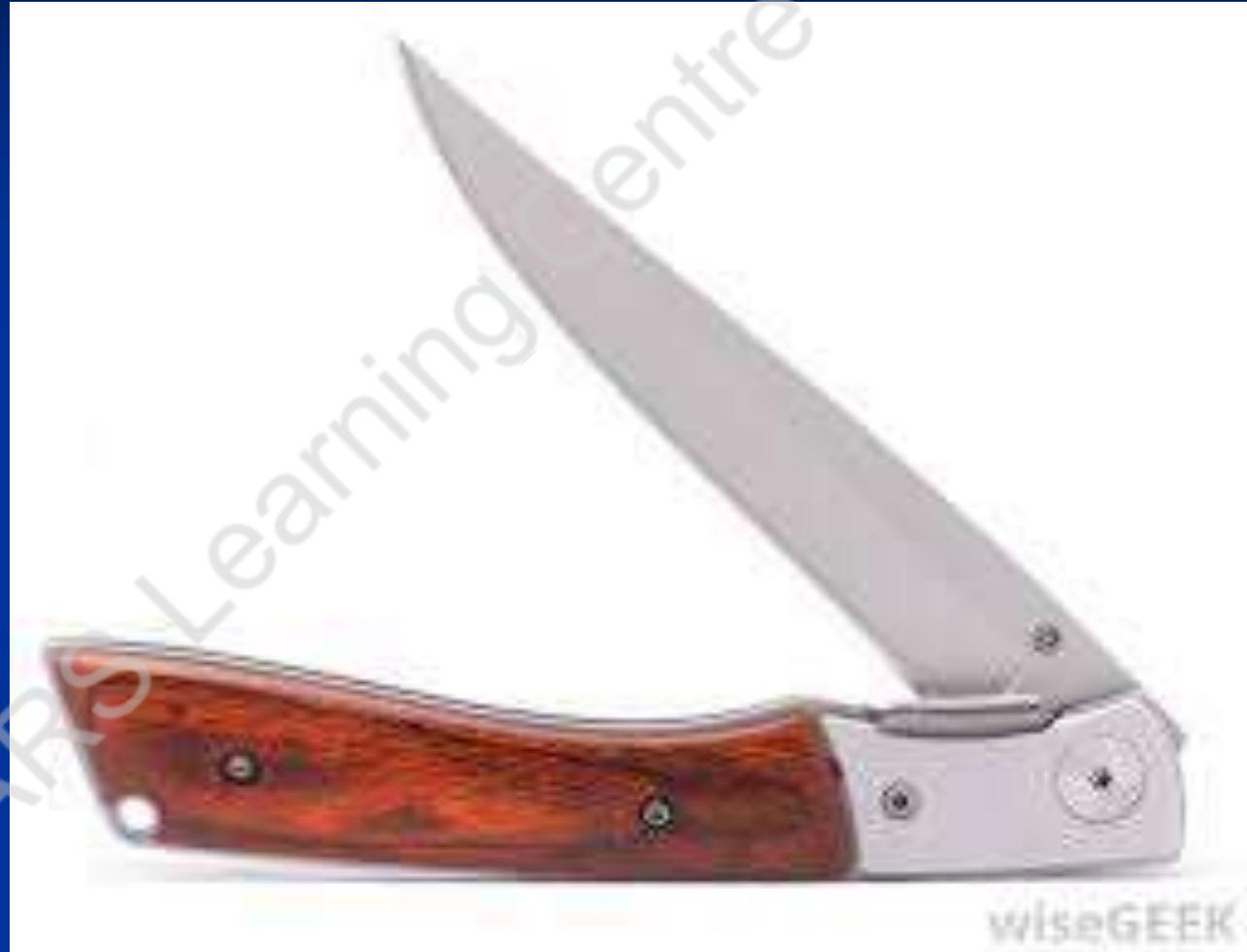


Figure 8.12 Positional asphyxia in acutely intoxicated individual.

Certain position in postural asphyxia

- Inversion, either of the whole body or the upper half trapped upside down
- Jack-knife position where the upper half of the body bent acutely downwards from the waist e.g. become stuck while trying to climb the upper part of the window
- Drunkness or other disability will lead the body to be slipped out of bed, with the head and shoulders are on the floor, with legs and pelvis still at higher position on the bed which result in decreasing the respiratory movements

- Jack Knife



Hanging

- Hanging is a type of mechanical asphyxial death due to constriction of neck structure by a ligature around the neck, where the constriction force being the weight of the body.

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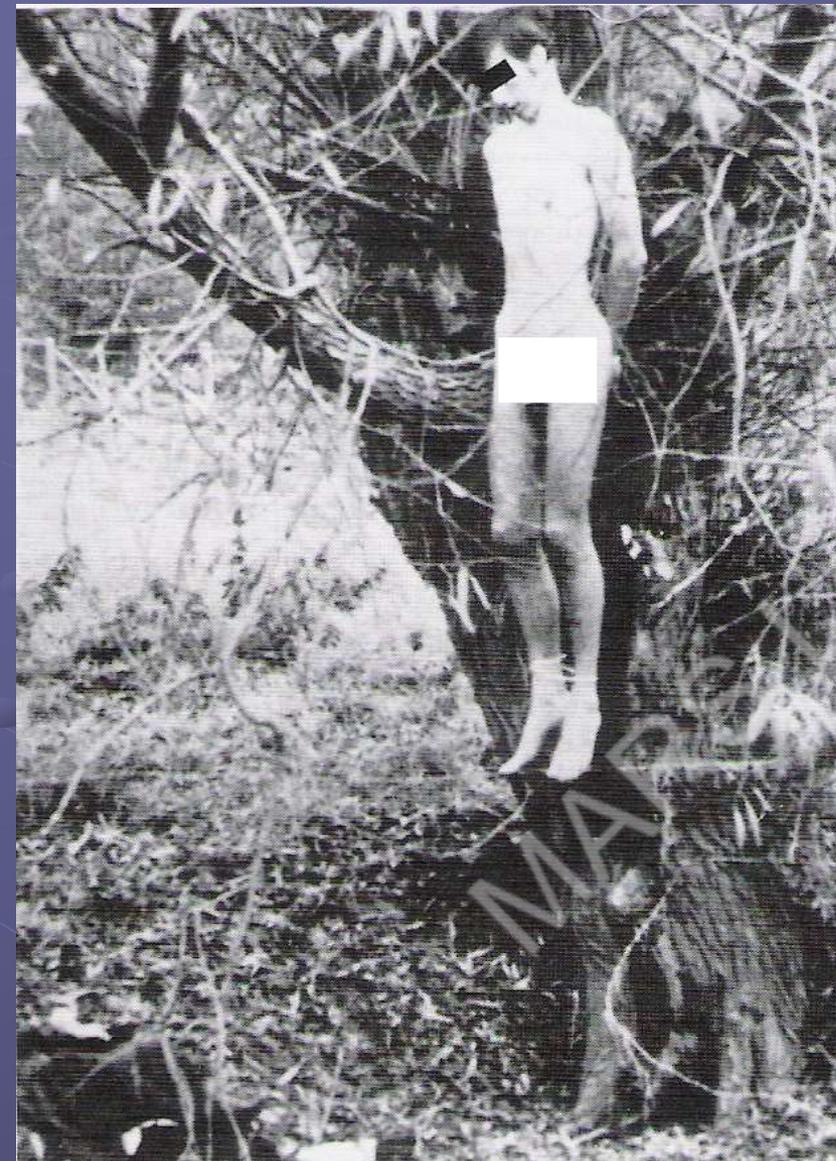




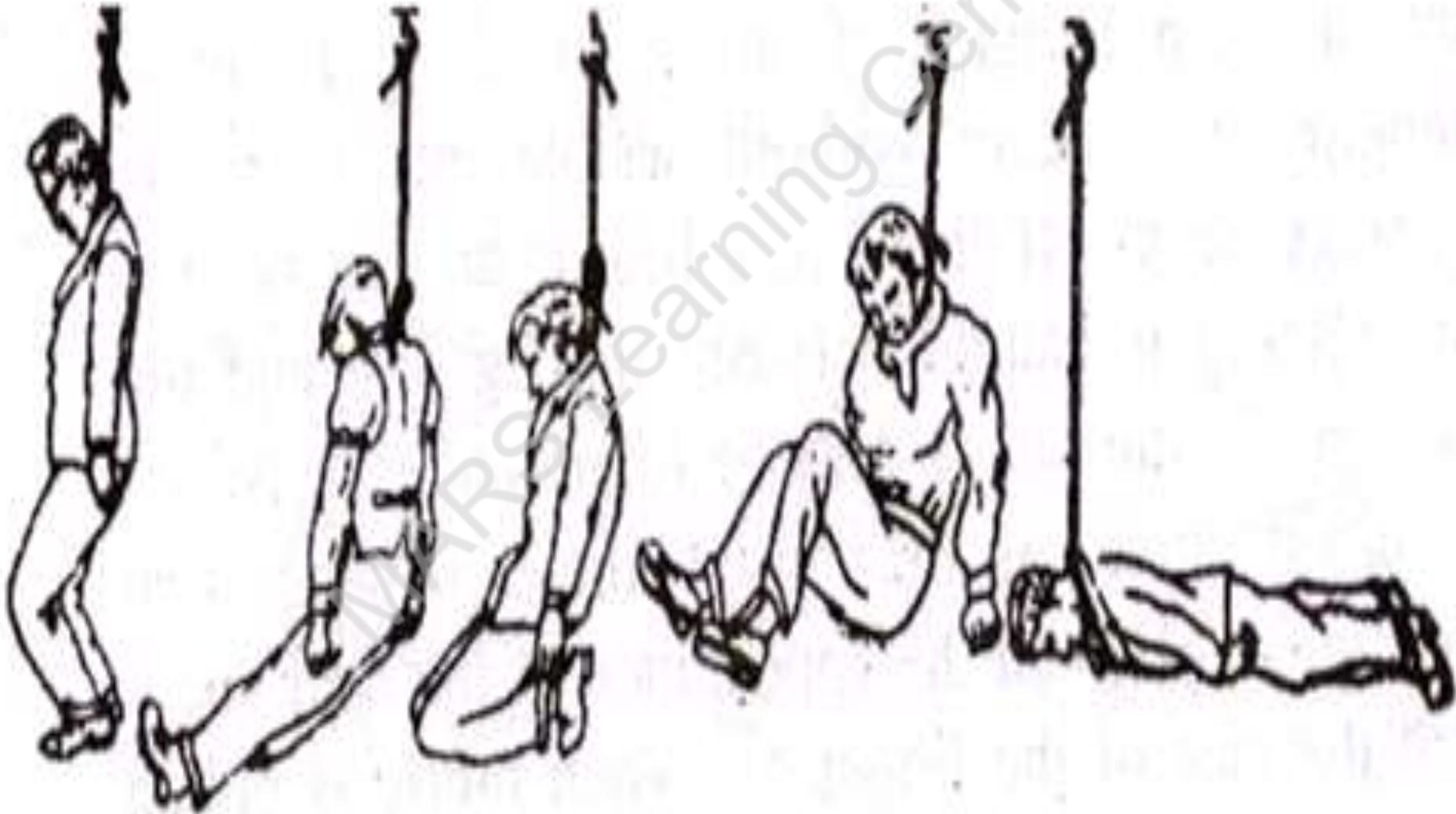
Types of Hanging

- Complete / Partial
- Typical/ Atypical

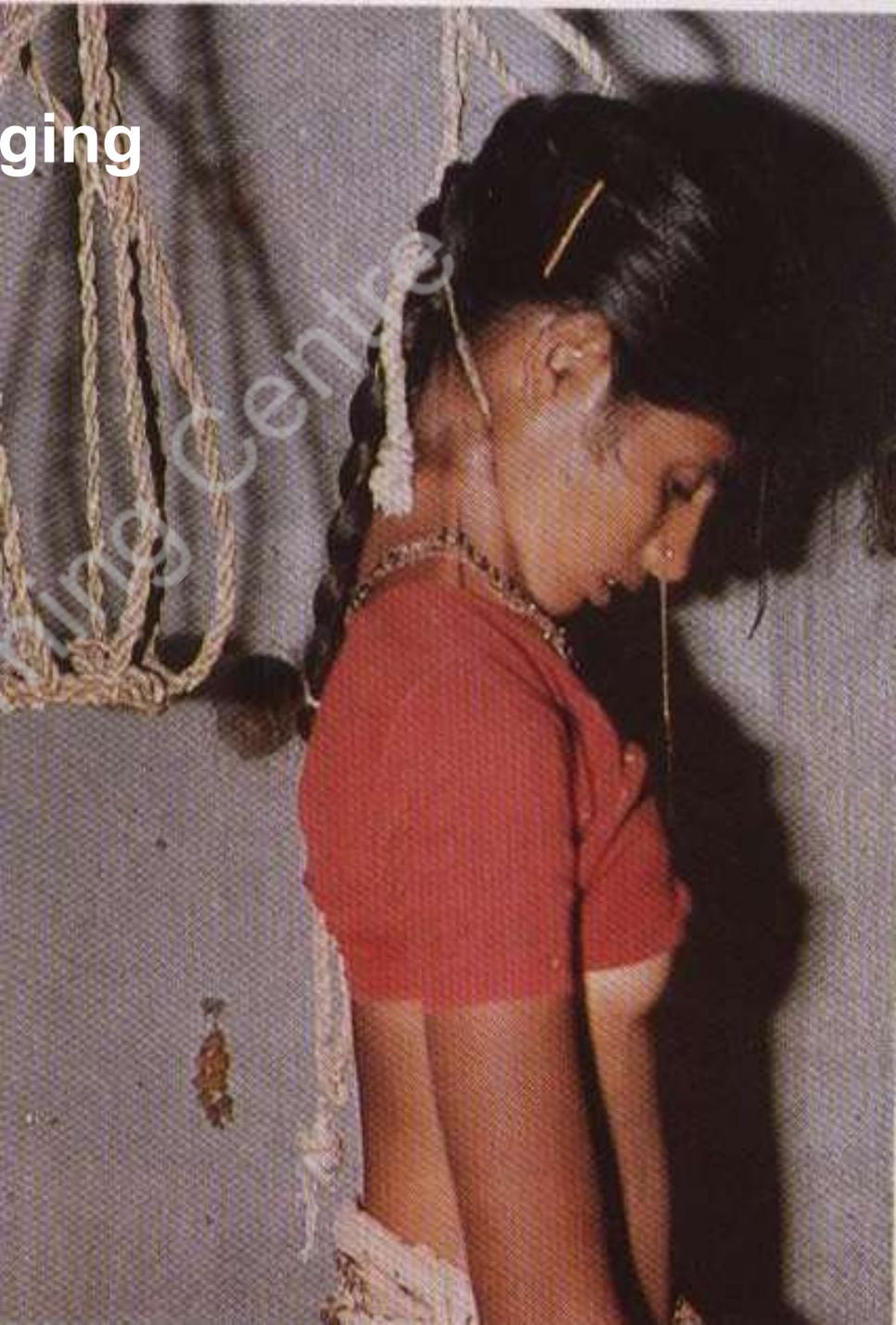
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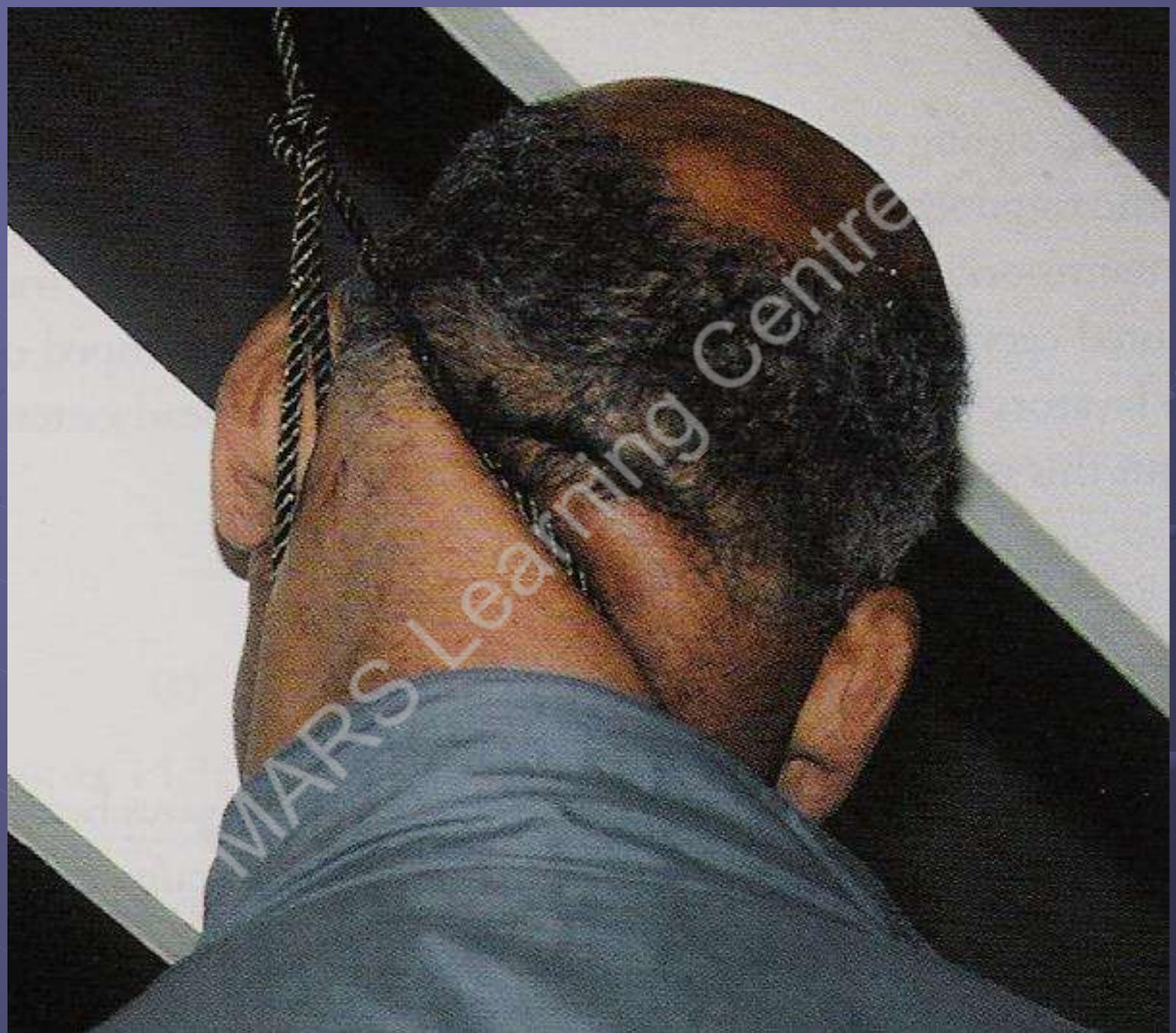


Partial Hanging

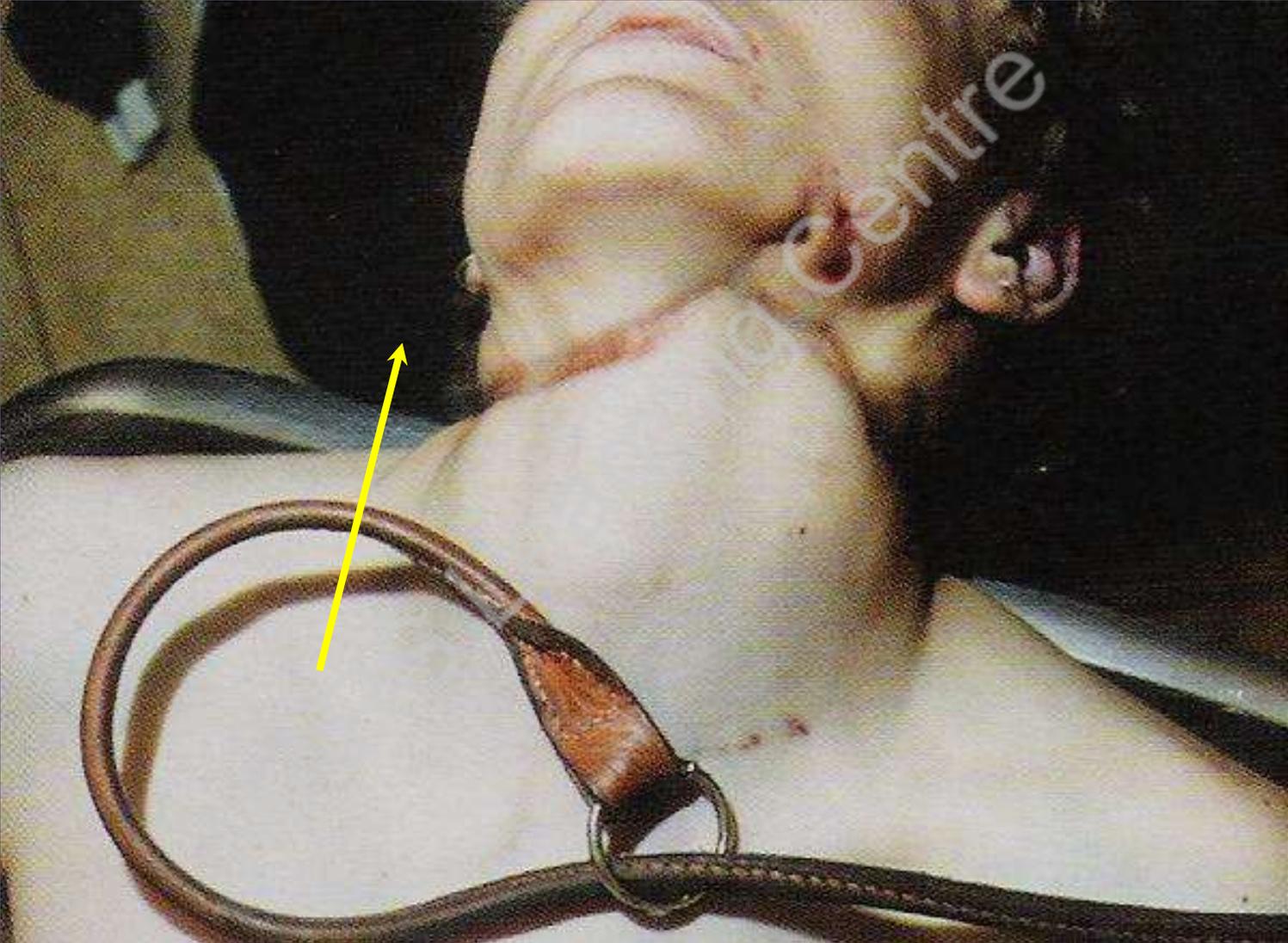


Typical hanging









Typical Hanging





Rope marks, imprinted on the skin of the back of the neck.
N.B. it can be seen in cases of hanging or strangulation.



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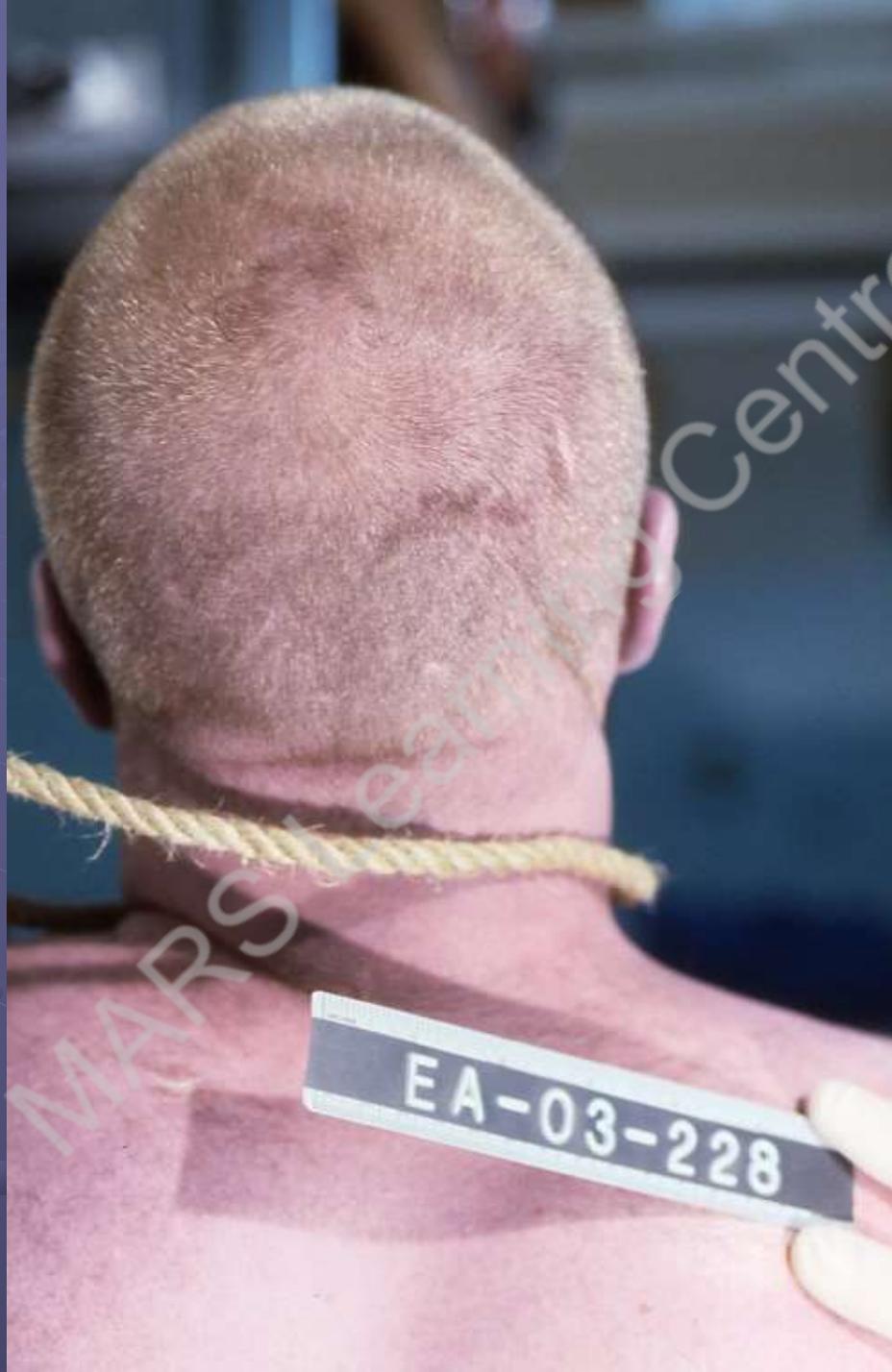
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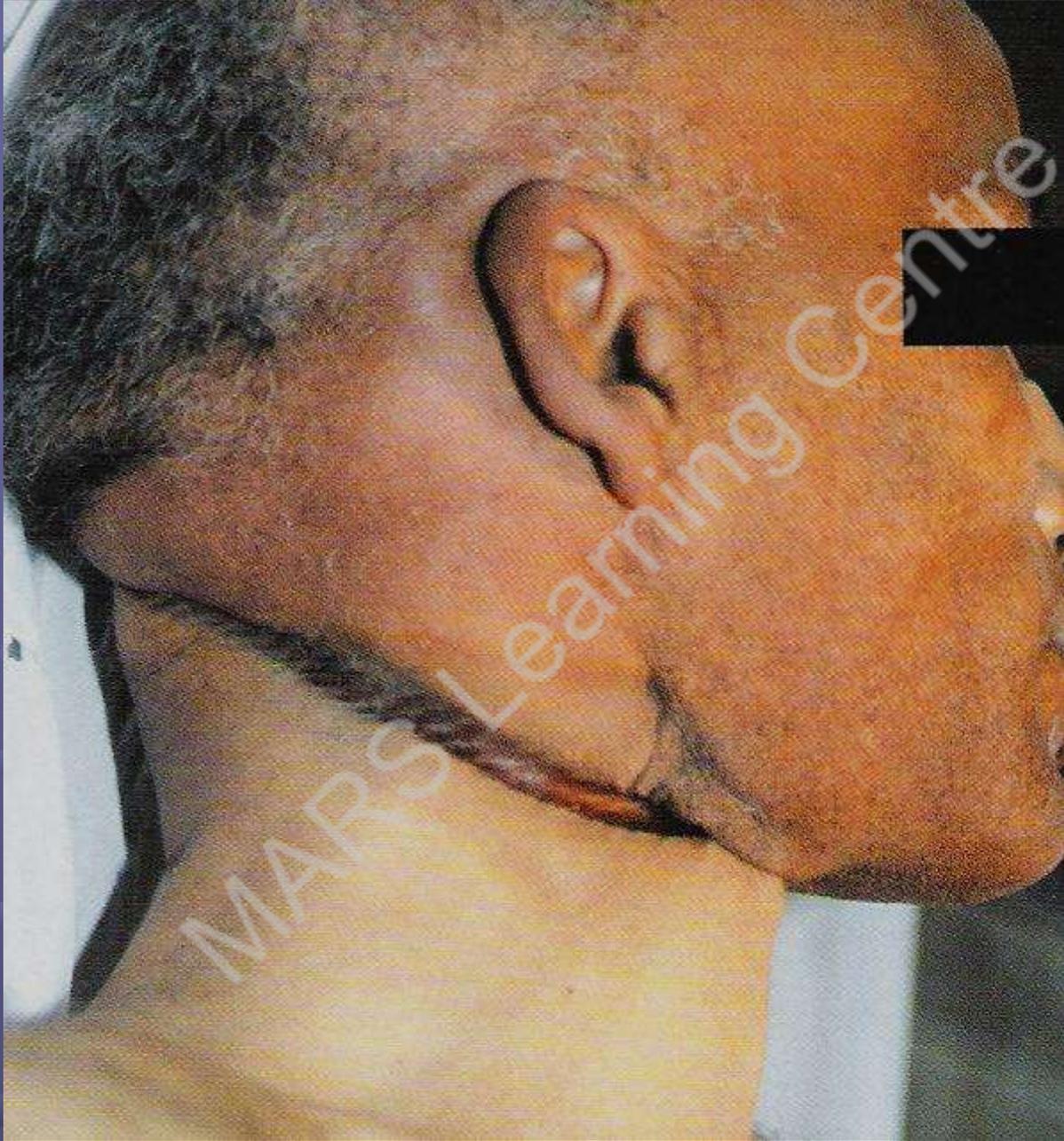




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Cyanosis, deep blue color of face and lips characteristic of death by asphyxia. G. Gresham,

Mechanism of death in hanging

- Stretching of carotid sinuses lead to cardiac arrest.
- Occlusion of carotids arteries.
- Venous obstruction.
- Airway obstruction by pushing the base of the tongue against the roof of the pharynx.
- Spinal cord and brain stem disruption.

Hanging

Other autopsy appearance of hanging:

- Distribution of postmortem hypostasis.
- Usually with pale face.
- Petechial haemorrhage in 25% of cases.
- Soft tissues haemorrhage in 30% of cases.
- Laryngeal fracture in 35-45% of cases.
- Intimal damage of carotid artery in region of the sinuses.

Fatal pressure on the neck

Mechanism of death

- *Airway obstruction: direct compression of the larynx or trachea (extreme force).*
- *Closure of the pharynx by the root of the tongue which pressed against the soft palate and roof of the mouth.*
- *Occlusion of the neck veins*

Fatal pressure on the neck

- Compression of carotid arteries: four or more minutes of occlusion of carotids lead to irreversible brain damage.

Nerve effects:

- Direct pressure of fingers or ligature and direct blow directed at the side of the neck will cause pressure on the carotid sinuses.

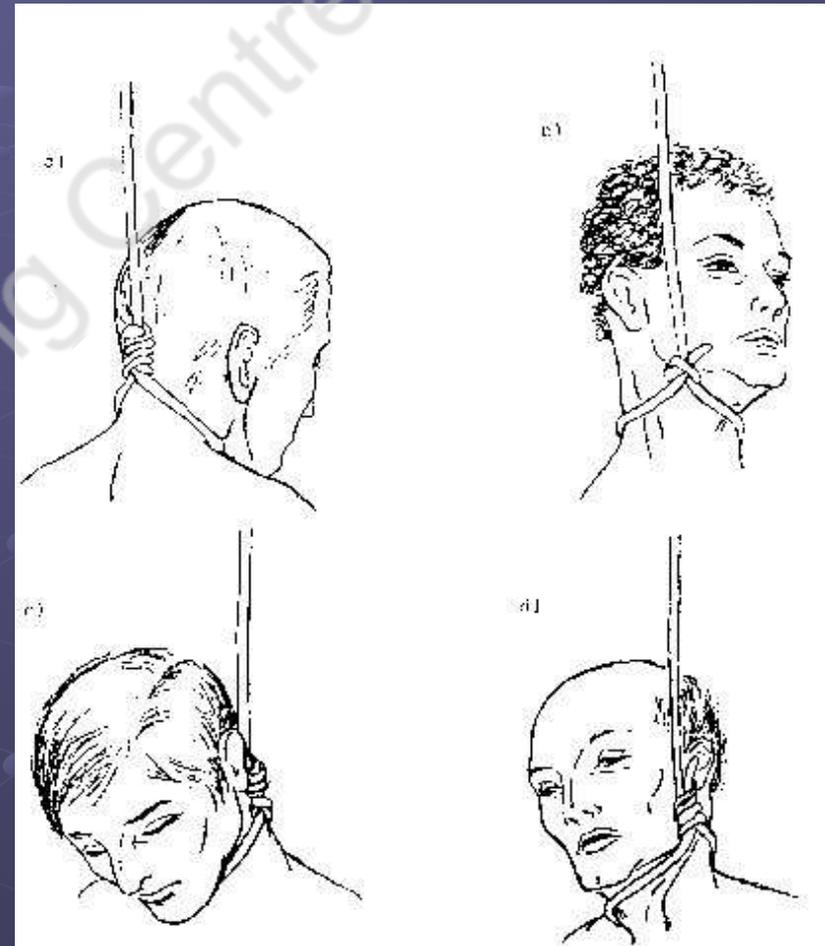
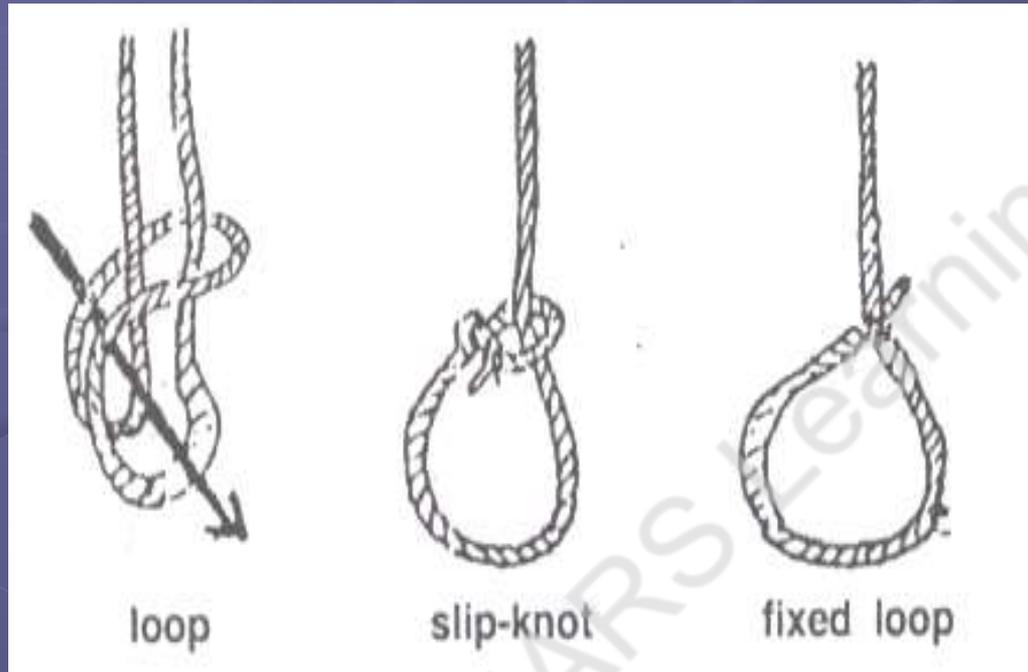
Fatal pressure on the neck

- The sensory nerve ending via the glossopharyngeal nerve to the brainstem and via vagus nerve efferent supply which will cause cardiac arrhythmia lead to cardiac arrest and no classic signs of asphyxia



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Types of knots



Fixed Noose



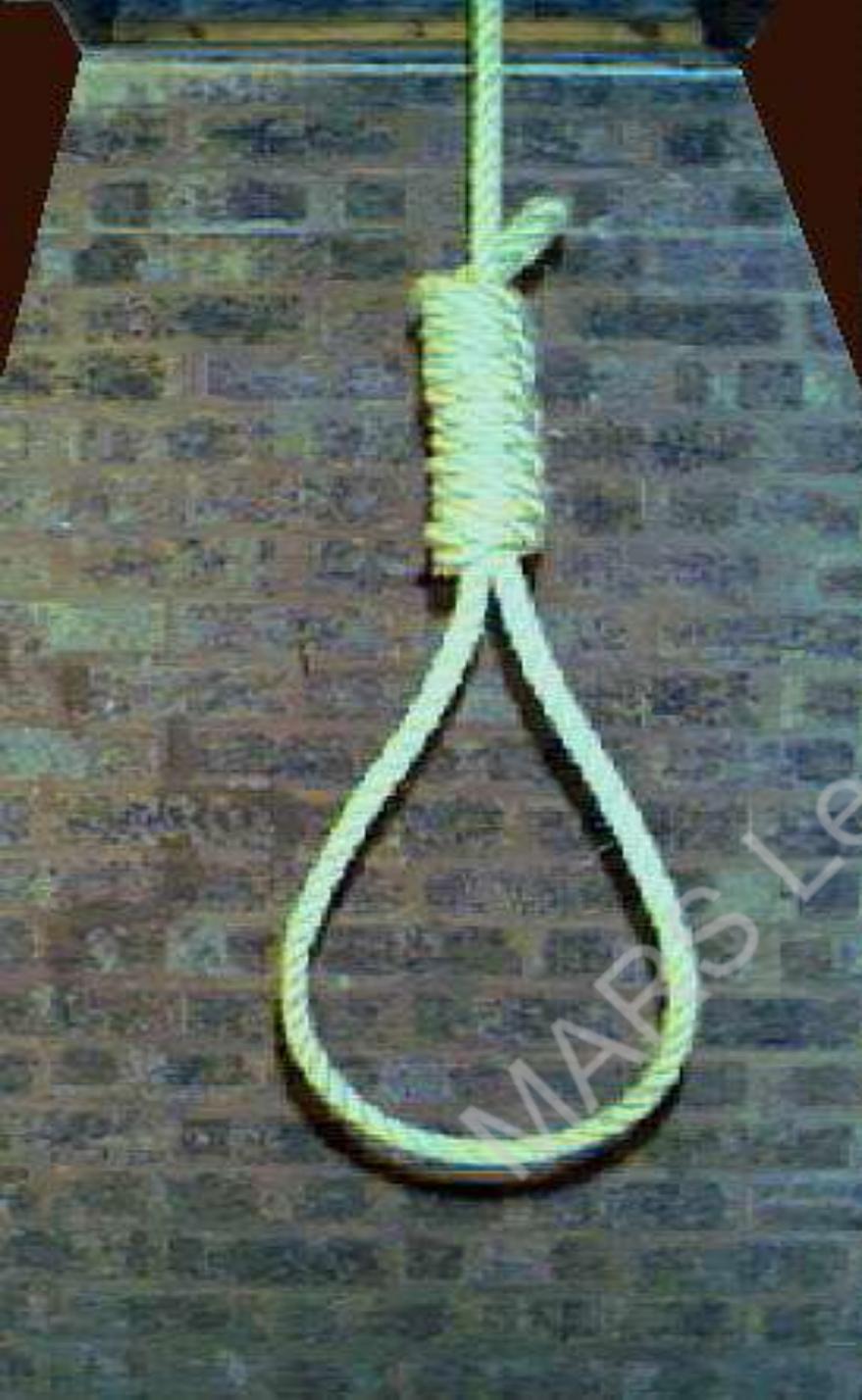
Running Noose (slip knot)



- Fixed noose - A mark on the neck which does not run around the full circumference of the neck.
- Slip-knot - noose is very tight and dig into the skin all the way around.
- Judicial, suicidal, accidental.

Preservation of Knot





In judicial hanging the noose used is of running type. It completely encircles the neck. A black mask is covered over the face and the noose is applied over the mask. When the trap door opens, the convict has a free fall and the fall is suddenly arrested by the rope. This snaps the cervical vertebrae and the spinal cord of the convict at the level of C1 and C2 and results in instantaneous death.

- A long drop of several meters like in judicial hanging disturb the cervical at atlanto - occipital joint, but usually in the mid-cervical spine.



Typical features of the externally visible ligature mark will be absent in judicial hanging because of the mask.



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**Note the trap door of
the platform**

- Mugging
- Garrotting
- Banskola
- Lynching
- Burking
- Le facie sympathique



Manual strangulation

- The victims usually woman or child. Performed by one or both hands, from front or back, the grip and even the hands may changed during the course of an attack
- External signs: abrasion and bruises on the front and sides of the neck, often along the jaw-line and each side of laryngeal prominence
- May be more widespread till the upper part of the sternal area in some cases.

Manual strangulation (Throttling)

- Bruises : disc-shaped area about a centimeter in size. They due to finger pressure, but with movements of the fingers, large irregular patches may occur.
- Abrasions : liner scratches from fingernails. Some of them may be due to the victim himself, trying to pull away the strangling fingers.



Look for finger tip bruises and nail marks on the neck in cases of throttling



Manual strangulation



Manual strangulation (Throttling)

Characterized by finger pulp bruises and nail marks.

These marks also helps to identify whether the assailant was right or left handed person

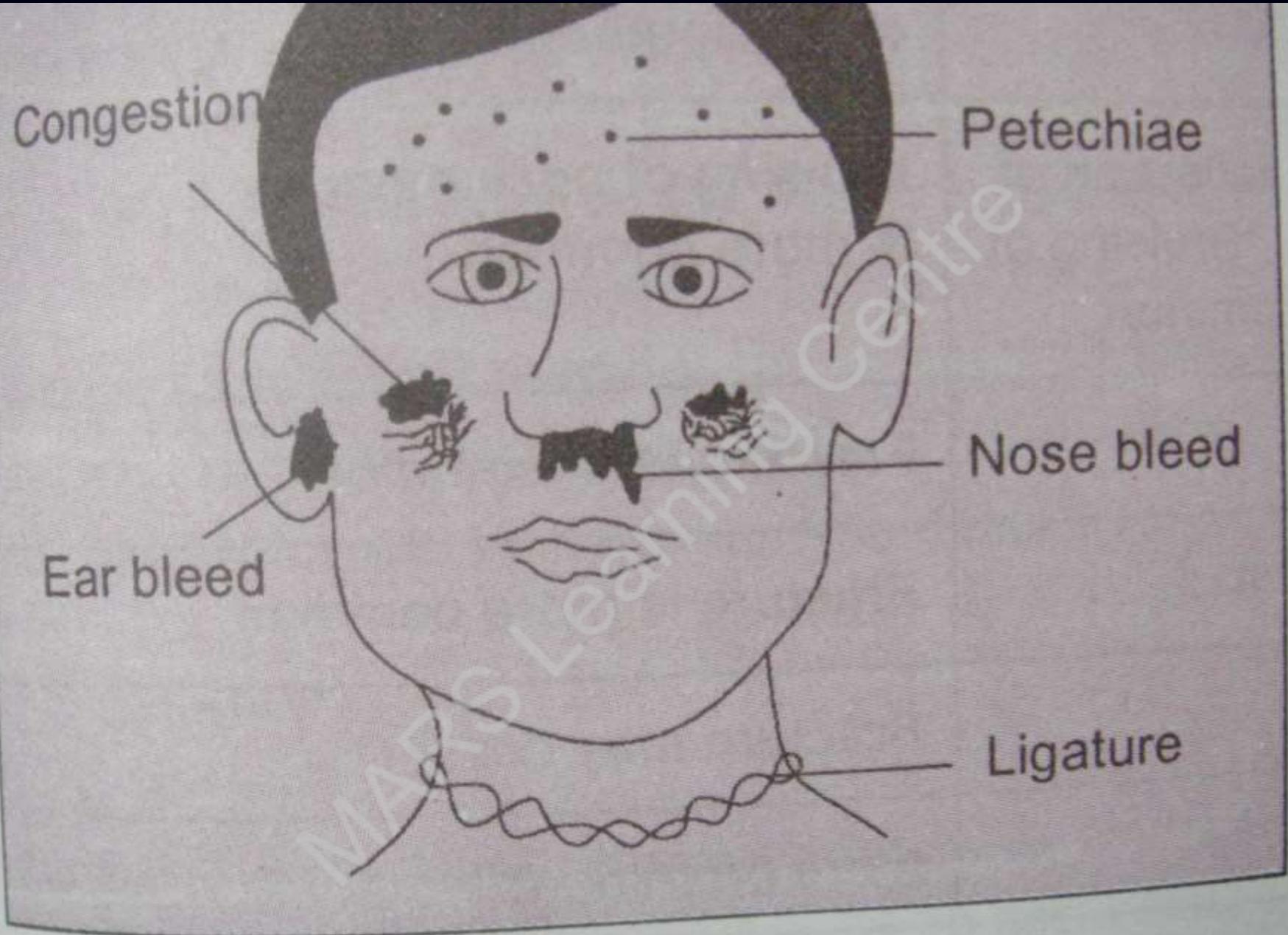


Fig. 13.9 Strangulation



Figure 13.5 Bruising of the neck in manual strangulation. Some of the bruises are due to the victim trying to release the grip of the assailant.



Figure 13.2 Conjunctival haemorrhages in manual strangulation.



Figure 13.1 Petechial haemorrhages on the eyelid in a case of manual strangulation.

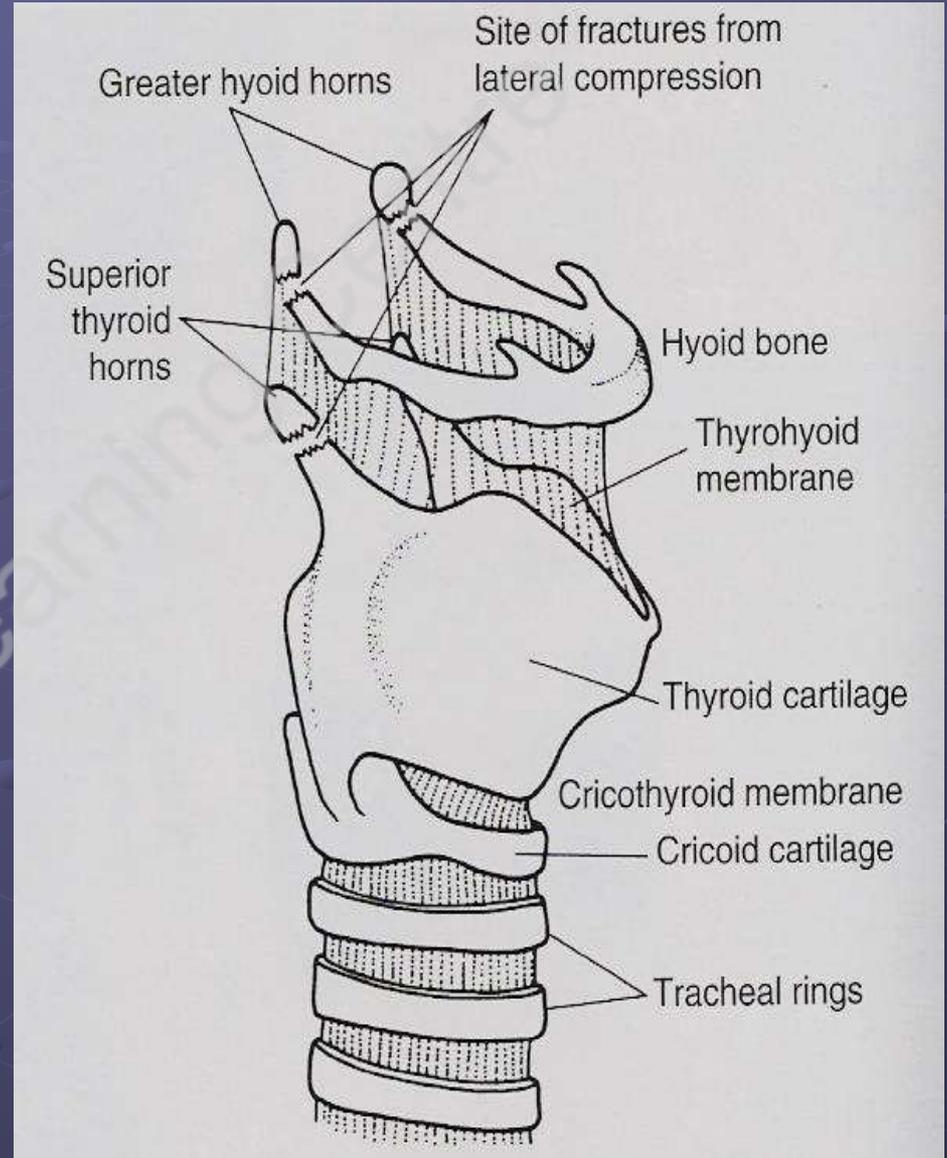
Manual strangulation

- Cardiac arrest here is more likely to occur than in ligature strangulation, as the fingers can impact on the deep arteries better than the more diffuse pressure of a ligature.
- When the pressure on the neck is prolonged and cardiac arrest doesn't occur, the following will be found : classic signs of venous obstruction; blueness, swelling, congestion of the face, showers of petechiae in the eyes and face, sometimes bleeding from the nose and ears.

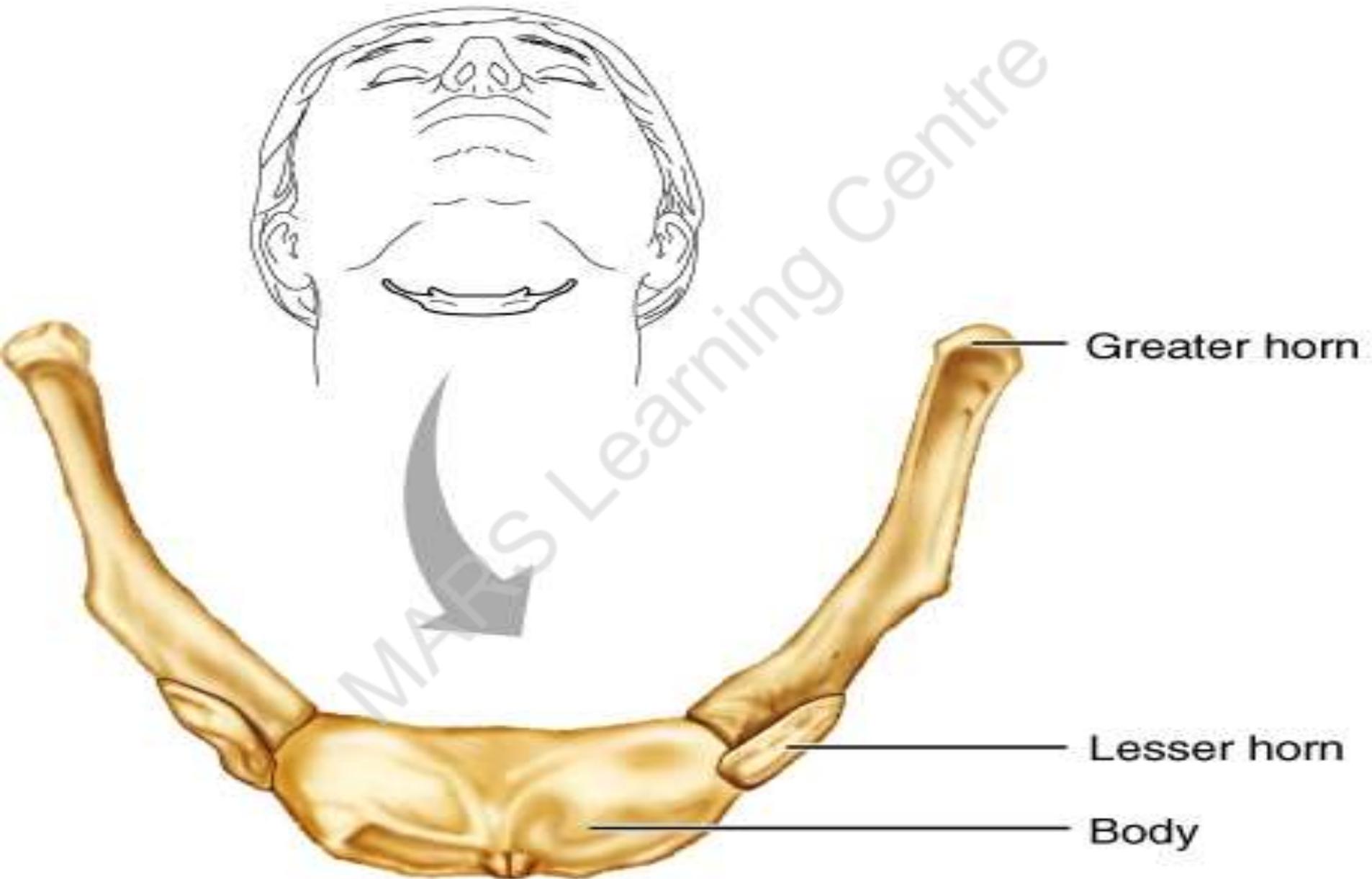
Manual strangulation

Internal autopsy findings of manual strangulation:

- Congestion and cyanosis of tongue, pharynx and larynx, petechiae on the epiglottis and visceral pleura.
- Haemorrhages under the skin of the neck and muscles of the neck.
- Fracture of superior horn of thyroid cartilage (common)
- Fracture of greater horn of hyoid bones (less common)



FRACTURES OF HYOID



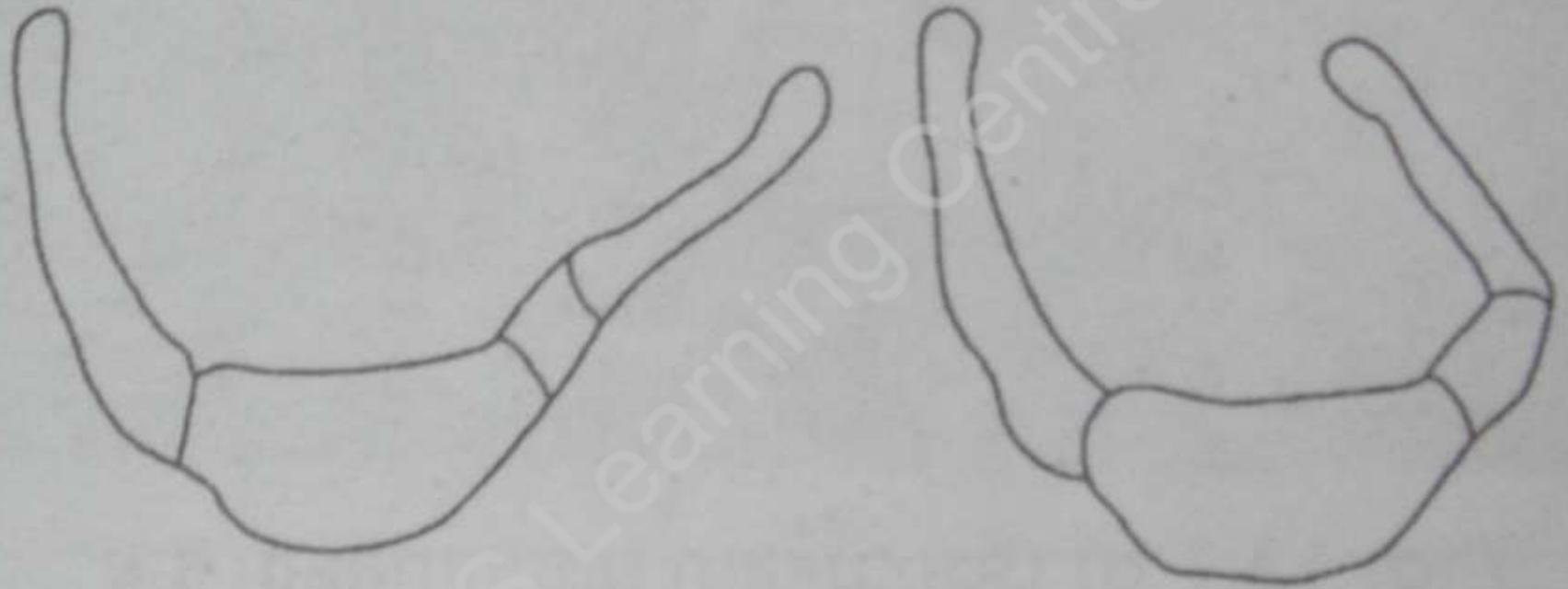


Fig. 13.8 Antero-posterior (left) and inward compression fracture (right) of hyoid bone

Ligature strangulation

- Constricting band is tightened around the neck.
- Classic signs of venous obstruction is more common to occur than in hanging and that in manual strangulation.
- Is usually homicide but can be accidental and suicide.
- Sudden death can occur from pressure on the carotid baroreceptors but not as frequently as in manual strangulation.
- All types of ligature can be used, such as rope, string, electric and telephone cable, scarves, stockings and pieces of cloth.

Ligature mark

- It is a vital piece of evidence.
- Width compared with size of the ligature.
- Brownish, dried leathery band and sometimes deeply sunk into the tissue.
- Red flare of vital reaction on either side and some petechial haemorrhage at the margin.
- The mark usually horizontal just above the laryngeal prominence.



Ligature mark completely encircles the neck in ligature strangulation. It is dry, glistening and parchmented

Ligature mark

- The mark goes around the whole circumference of the neck and there may be mark of cross-over or knot.
- Will not show a raising peak to a suspension point, as do many hangings.
- Clear cut and deep with sharply defined edges if wire or thin cord was used.
- Diffuse and faint if a soft fabric was used.

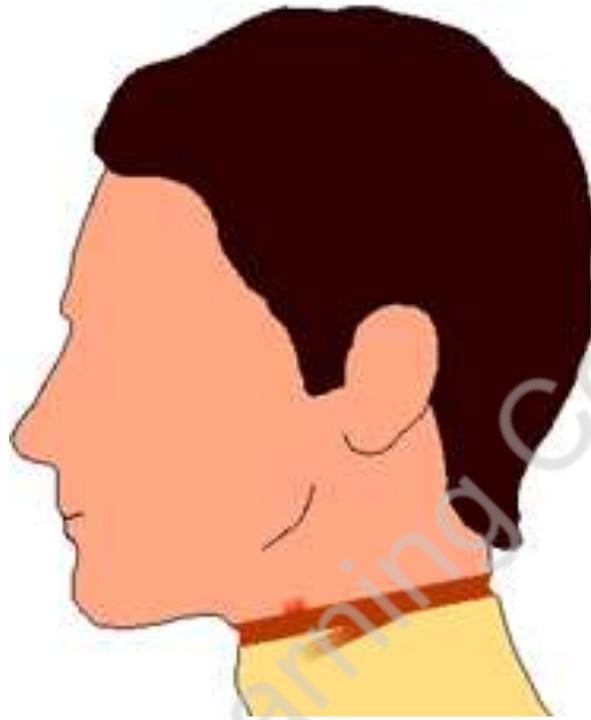
Ligature mark

- Fabric like scarf and towel may produce a relatively narrow mark, as stretched fabric will often pull into one or more tense bands, which then act as a narrow ligature.
- Occasionally a ligature mark may only be across the front of the neck, if the assailant presses from the front or pulls from the back, using a cord stretched between two hands.

Ligature strangulation

- Scratches and bruises on the neck either from the victim or attempts at manual strangulation.
- Internal findings are same as in manual strangulation, only the fracture of the larynx are less common and the haemorrhage in the neck muscles less severe.





In strangulation the ligature mark is horizontal, at or below the level of the thyroid, completely encircles the neck and is mostly homicidal in nature.



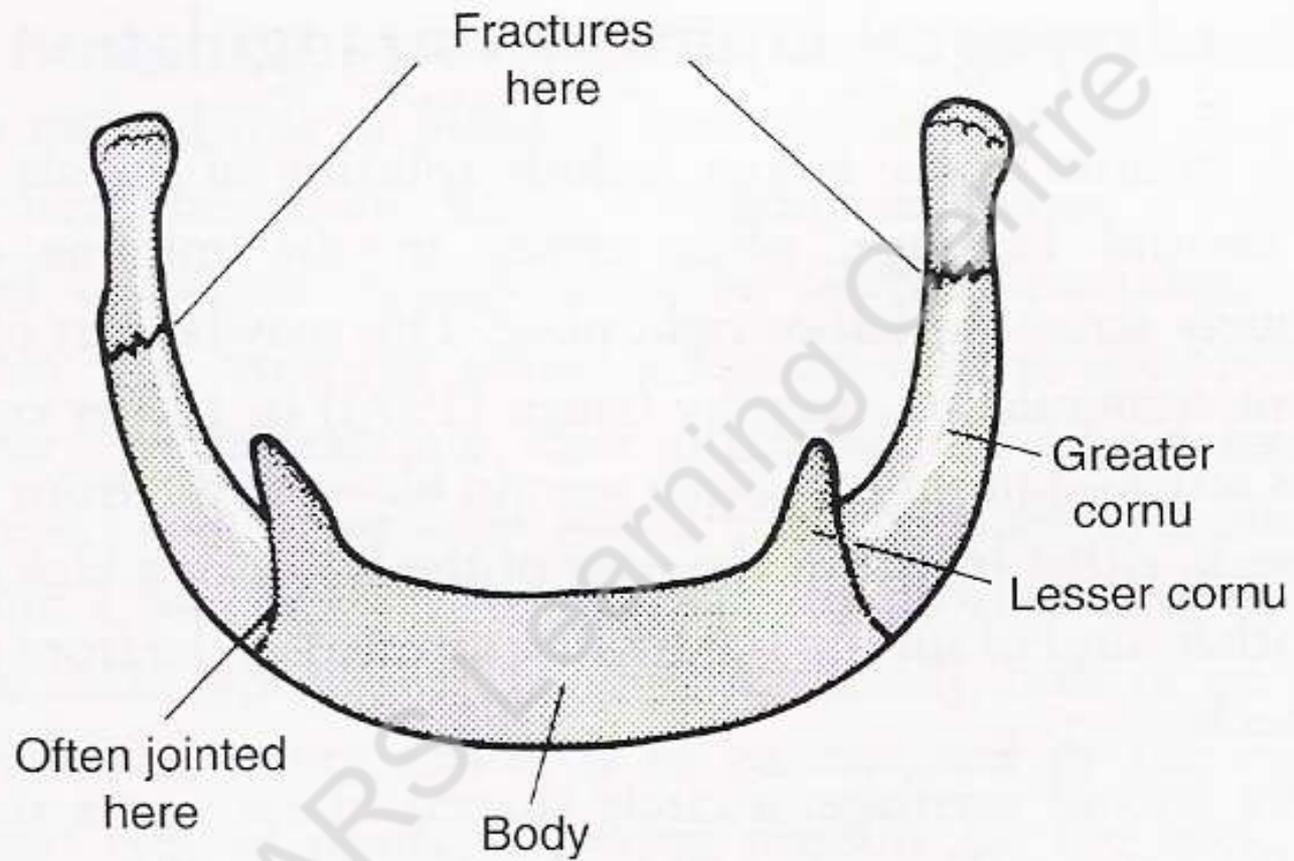
**Bleeding through the nose and ears
are common in strangulation**



Sub conjunctival haemorrhage



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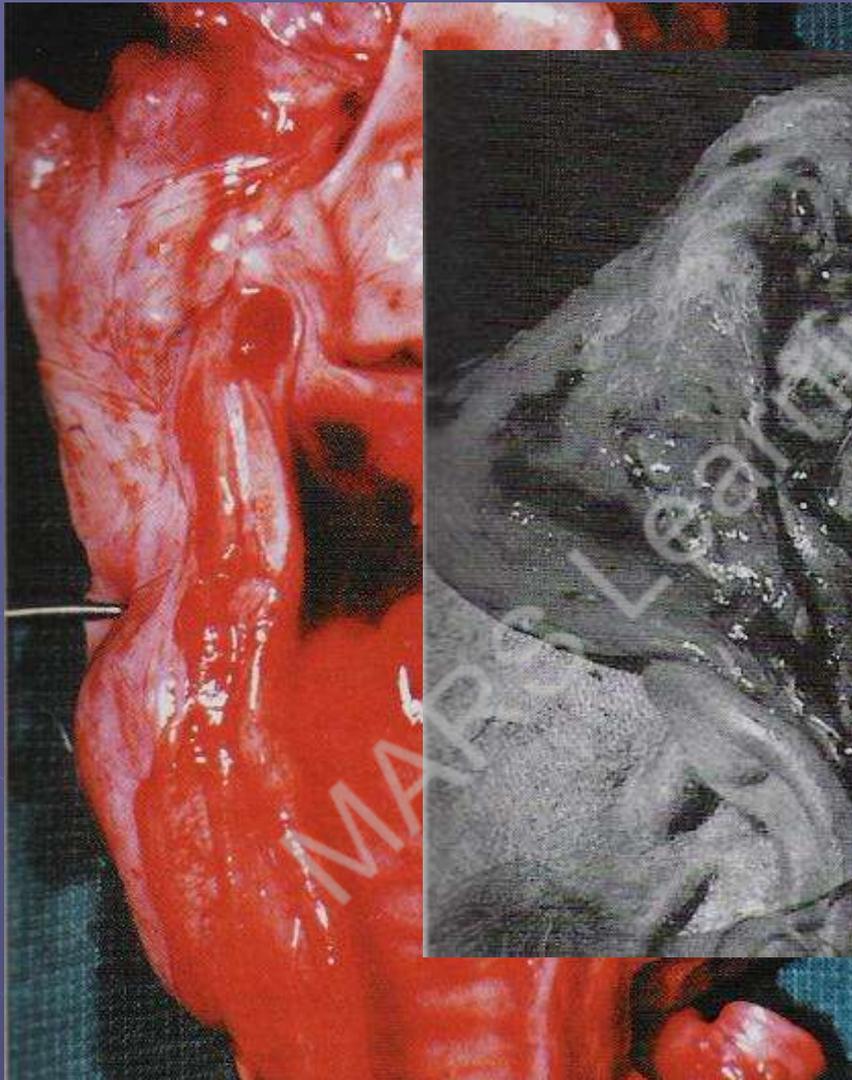


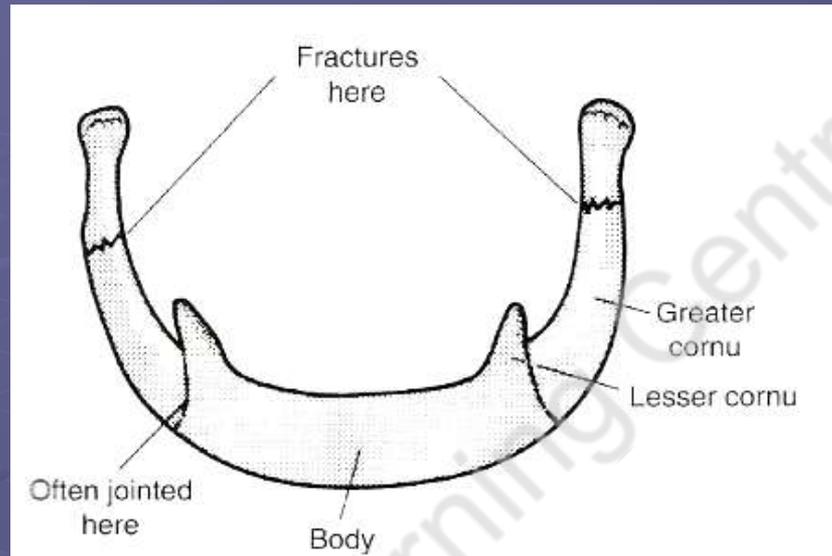
Visible Signs



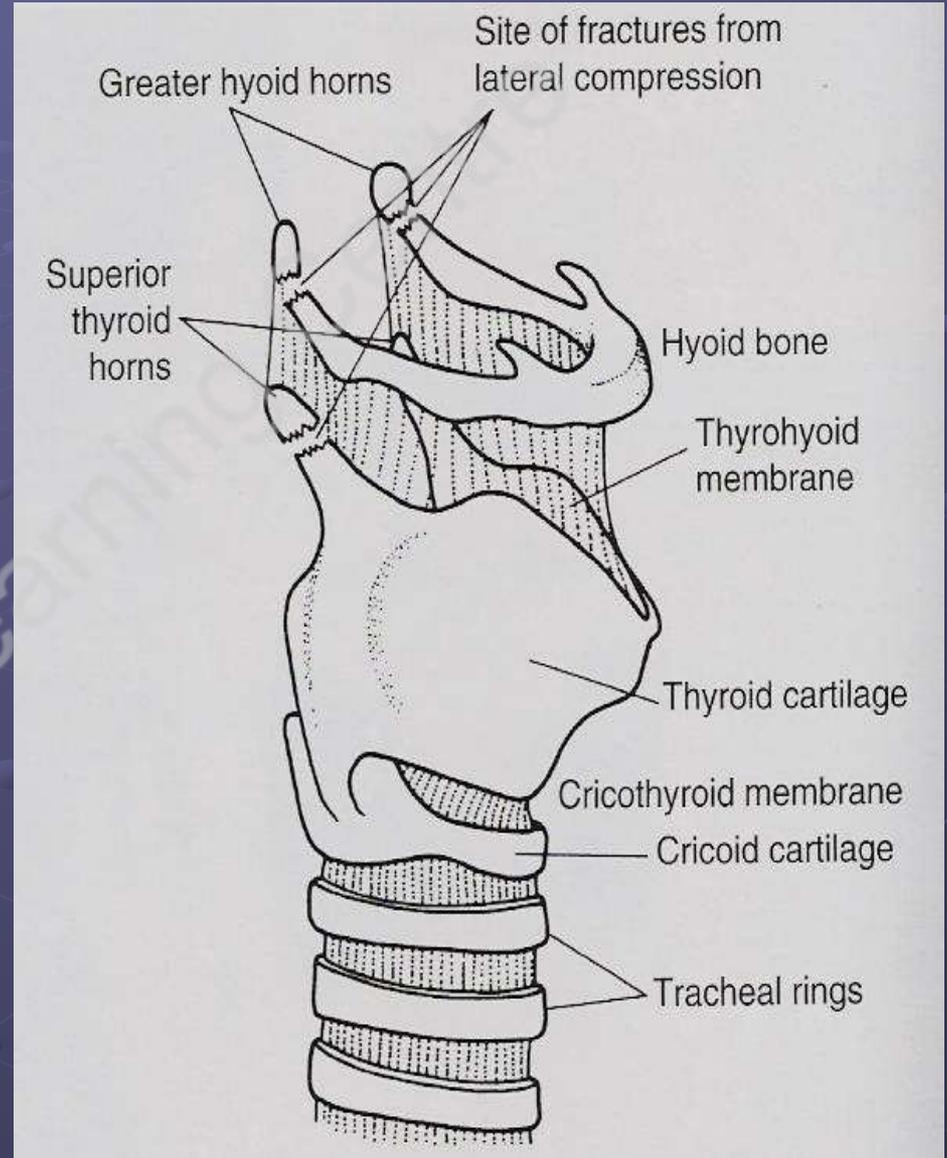


Mucosal hemorrhages





- Fractured hyoid bones are often observed although, in younger subjects, calcification has not fully set in.



Sexual asphyxia

(Masochistic practice) (Auto-erotic asphyxia)

- Man between puberty and middle age.
- Pressure on the neck or partial cerebral ischemia achieved by some form of hypoxia , leads to erotic fantasies which are deliberately induced by the person on himself

Sexual asphyxia

- When sexual gratification is achieved, the person came back to normality by release of restriction
- But sometimes the technique malfunctions and death occur
- It's usually accidental.



Auto erotic sexual asphyxial death

Common features:

Exclusively in white males.

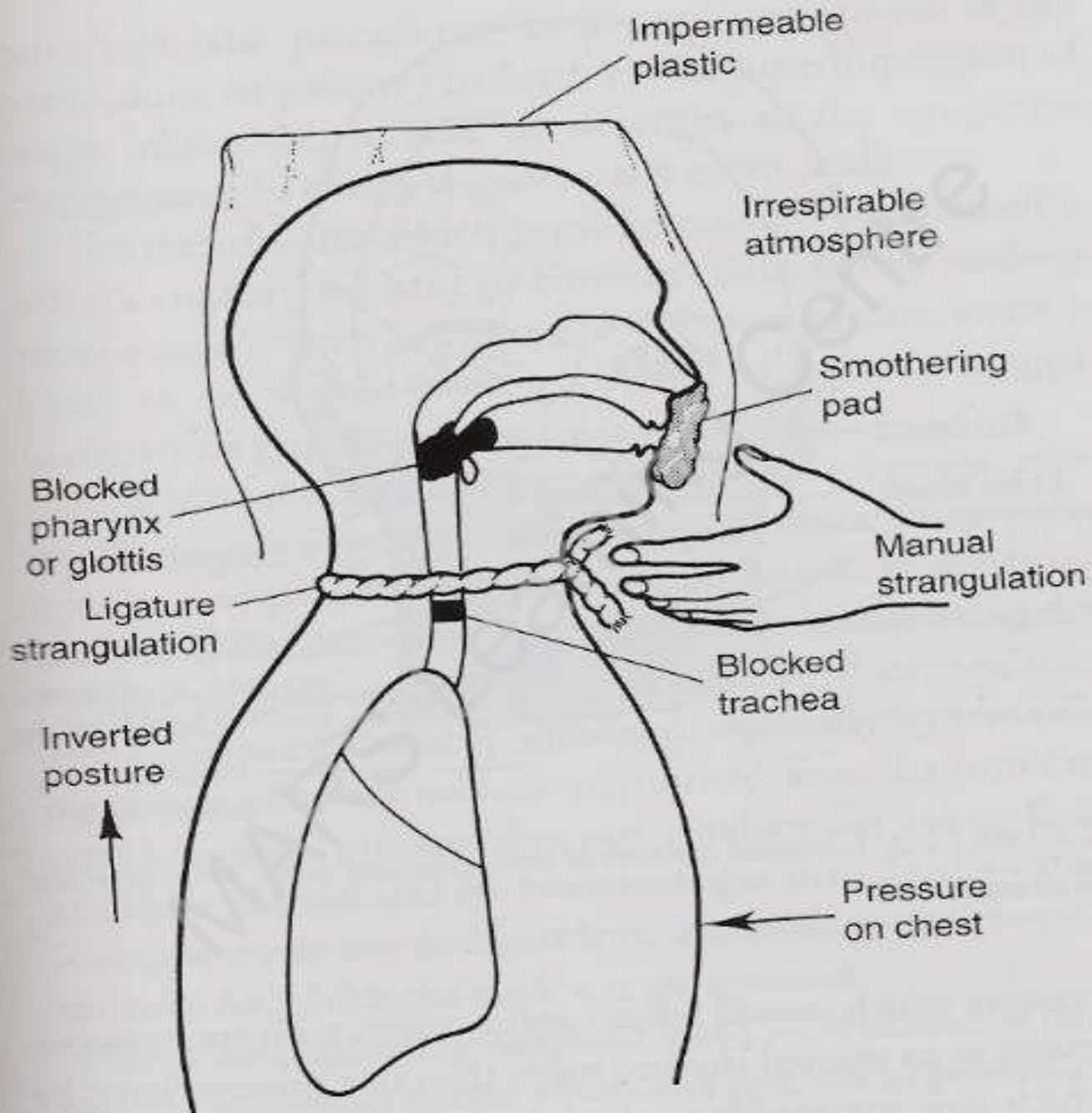
Death is always accidental.

Secluded places.

**Pornographic literature or
photos in the surroundings.**



**Accidental strangulation and smothering
during the perverted act**

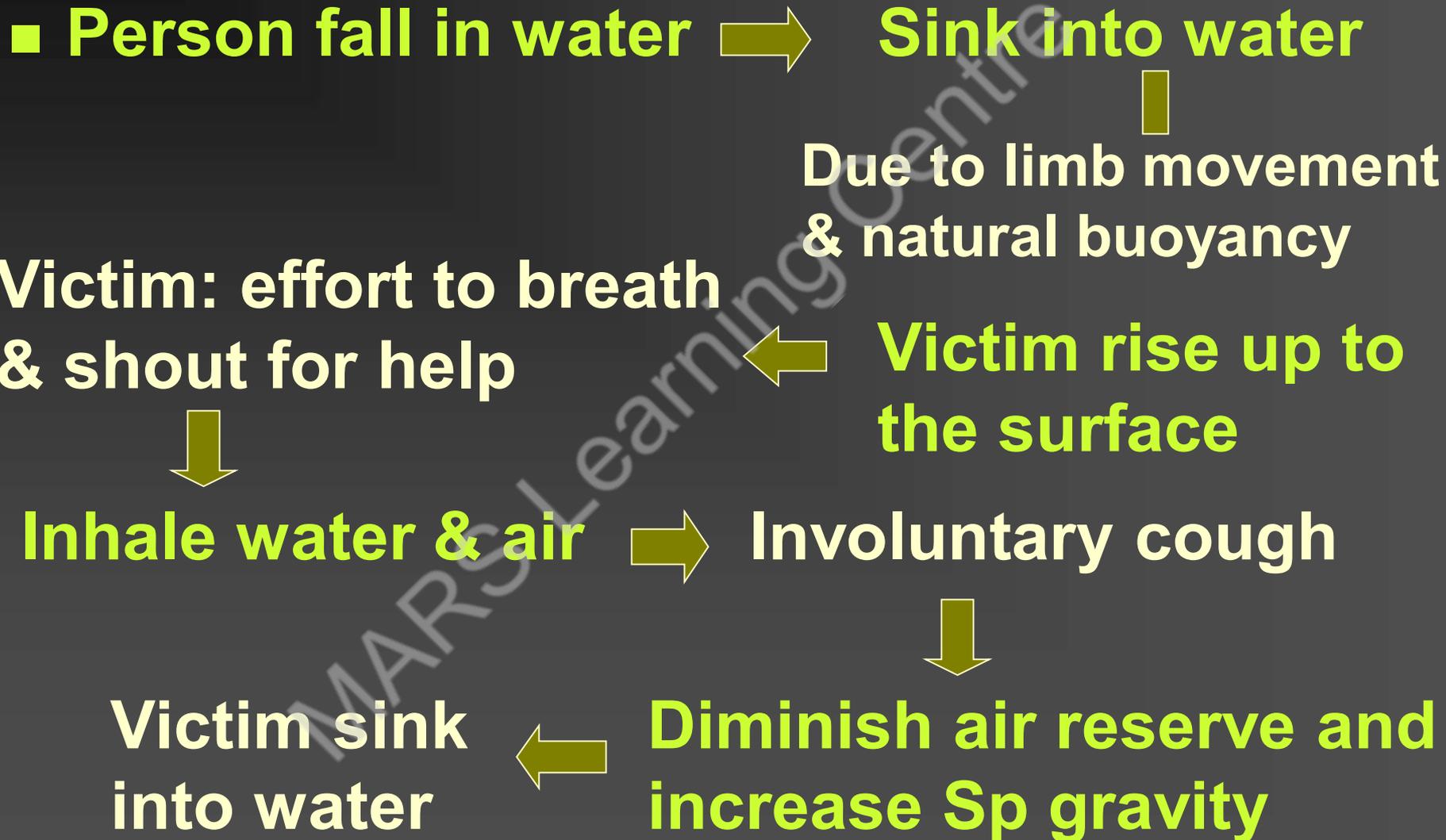


Drowning

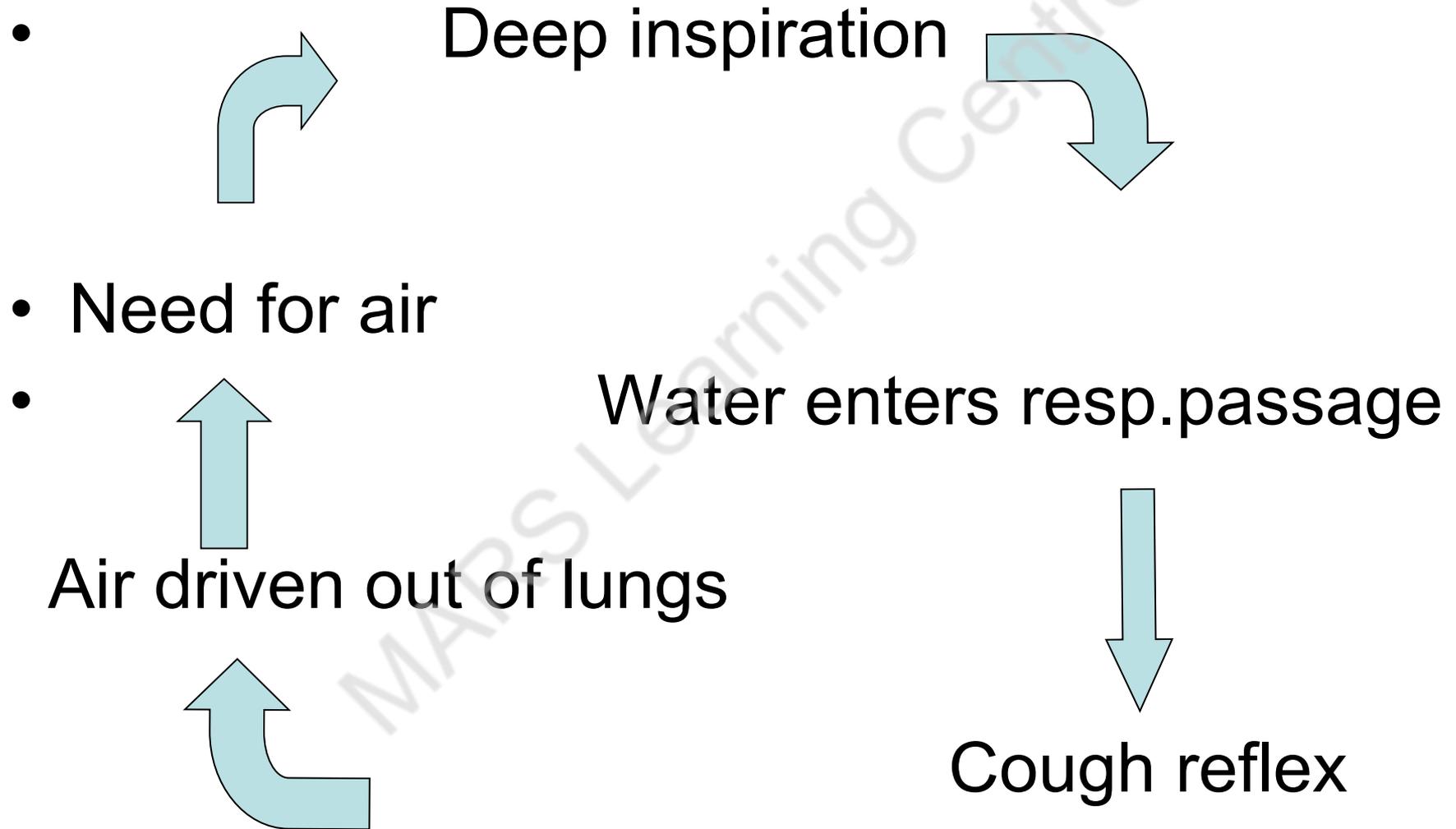
- **Drowning** is a form of asphyxial death due to aspiration of fluid into air passages, caused by submersion in water or other fluid
- Complete submersion of the body is not required to cause the death

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Mechanism



Vicious cycle of drowning



Several questions needs to be addressed

1. How did the person enter the water (dead or alive) ?
2. Why could that person not get out of water?

“Recovery of a body from water does not mean drowning”

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- Drowning death, sometimes, poses challenges to forensic expert
- To add to the difficulty, autopsy findings in deaths due to causes other than drowning, may as well resemble features of drowning deaths
- Moreover, in cases of post mortem drowning, prolonged submersion and onset of decomposition may result in features similar to ante mortem drowning deaths

“Diagnosis of drowning is by exclusion”

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Exclusion of other causes of death in drowning death case:

- Death due to Natural disease
- Death due to Head injury
- Death due to poisoning
- Death due to electrocution
- Death due to complex suicide attempt
- Death due to homicide

- Exclude all other possibilities of death
- And finally establish the diagnosis of drowning with “consistent findings” suggestive of drowning

Meticulous autopsy alone may not be conclusive

One may have to resort to:

- Anamnestic data
- Psychological autopsy
- Visiting 'Scene Of Incidence'
- Corroborative evidence
- Circumstantial evidence
- Toxicological and Histopathological analysis etc.

Immersion and Drowning

Bodies recovered from water may have :

- Died of natural causes before entering the water.
- Died of natural causes while in the water, having entered the water either voluntarily or accidentally.
- Died from exposure and hypothermia in the water.
- Died of injuries or other unnatural cause before entering the water.

Immersion and Drowning

- Died of injuries after entering the water
- Died from true drowning as a result of aspiration of water into the lungs

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Shallow water Drowning

- Drowning occurs in small water pits,
- Victims: Disabled, incapacitated, epileptics, drunkards, comatose etc
- Merge of mouth & nostril
- Either accidental or homicidal

- The diagnosis of drowning should always be deduced by exclusion of other causes of death

CLASSIFICATION

- Typical (wet drowning)
 - a. Fresh Water
 - b. Salt water.
- Atypical
 - Dry drowning
 - Immersion syndrome
 - Submersion of unconscious
 - Near drowning (Secondary drowning syndrome)
-

FRESH WATER.

- Large volumes of water cross the alveolar membrane & enter the circulation – hypervolemia – hemolysis- hyperkalemia – ventricular fibrillation-cardiac arrest/**heart failure** & cerebral anoxia.
- Haemolysis -Cardiac anoxia-hypotension- **heart failure**.
- Death occurs in 4 to 5 minutes.
- lung is pink and crepitus

SALT WATER.

- Salt water enters lung -pulmonary oedema - hypoxaemia
- Salt water enters lung -causes fluid to drawn from circulation into the lungs – hypovolemia – Hybernatremia – electrolyte imbalance- metabolic acidosis
- Hypertonicity of water – crenation of RBC – reduced O₂ carrying capacity- cardiac anoxia
- Death occurs in 8 to 10 minutes.
- Lung is voluminous and purple in colour

■ Gettler's Test

- Heart (cl) : Rt 600mg%, Lt 600 mg% each in both ventricles.
- Cl raises in sea water by 30-50% in left ventricle
- Cl drops by 50% in fresh water in left ventricle

DRY DROWNING

Water does not enter the lungs because of laryngeal spasm.

(WET DROWNING-Water is inhaled and enters the lungs).

SUMBERSION OF THE UNCONSCIOUS

- A person struck unconscious due to myocardial infarction, head injury, epileptic fit, etc. And falling into water. Signs of drowning , but negligible.

IMMERSION SYNDROME

- Due to impact with cold water there is vagal inhibition & reflex cardiac arrest.
- Also occurs from wrong diving technique.
- Alcohol predisposes.
- **Features of drowning will be absent**

Secondary Drowning

■ Syn : Near Drowning

- Immersion in water is the predisposing cause of death
- Death may occur between 30 mins to several days
- Death due to complications in a rescued victim of drowning – Pulmonary edema, aspiration pneumonia, electrolyte imbalance etc.

CAUSES OF DEATH in Drowning

Asphyxia – due to obstruction to air passages by fluid or laryngeal spasm.

Vagal inhibition, Ventricular fibrillation or asystole,
hypoxaemia and metabolic acidosis

Late complications

Associated Injuries-eg. - Near Drowning, Brain
Compression following head injury

POSTMORTEM APPEARANCES in Drowning

External features

1. Wet clothes
2. Wet, Cold, Clammy skin
3. P.M. Lividity over face, neck & chest.
4. Asphyxial signs (not very prominent)
5. Froth at mouth & nostrils (Copious, fine, white & lathery) – reappears even when it is wiped away.
6. Cadaveric spasm of the hand (rarely seen).

7. CUTIS ANSERINA- ie. Goose-skin appearance.

Occurs due to spasm of erector pilorum muscles of skin, resulting in a puckered appearance with hairs standing on end.

8. WASHERS WOMAN'S HANDS & FEET-

Soddened, bleached, wrinkled skin of palms & soles, due to prolonged contact with water (12 hours or more).

Postmortem Appearance in Drowning

External Appearances:

- Face : congested with cyanosis
- Occasional petechial hemorrhage
- Eyes: Subconjunctival hemorrhage
- Postmortem lividity : face, chest hands, lower arms, feet

Postmortem Lividity-Face, neck and chest



Cyanosis





Cutis anserina



MARKS Learning Centre

- Characteristic froth : white, fine, lathery, tenacious, often tinged with blood & when wiped away it reappears gradually
- Froth is a characteristic antemortem sign of drowning.

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Tenacious,
white lathery,
fine froth



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Tenacious,
white lathery,
fine froth



Washerwomen's hand



Washerwoman's hand :

- Wrinkled, soddened & bleached appearance of the palms & soles – 24 hours.
- Peeling off of skin by 72 hours

Washerwomen's hand



Washerwomen's feet





Washerwoman's hands and feet



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Gravel, Mud, Sand, Weeds or aquatic vegetations may be held in clenched hand due to Cadaveric Spasm



- Struggle of the victim for life
- Ante-mortem proof of drowning



Figure 6.1 Cadaveric rigidity – a rare condition. This victim grasped at some ivy as he fell into water.

II. INTERNAL FEATURES

- Emphysema Aquosum: - Water – logged voluminous lungs which pit & crepitate on pressure. Visceral pleura may show coin – sized paultauf’s hemorrhages. Cut section reveals congestion with oozing of blood- stained frothy fluid.
- Froth in airways.
- Water in stomach & intestine.
- Water in middle ear
- Congestion of other viscera.

Internal Findings

- Stomach & intestine: Evidence of water swallowing- Gravel, dirt, sand, aquatic vegetations, shells etc.
- It is a positive sign of ante mortem drowning
- **Absent in:** Death due to Vagal inhibition, unconsciousness before falling into water

Internal Findings...

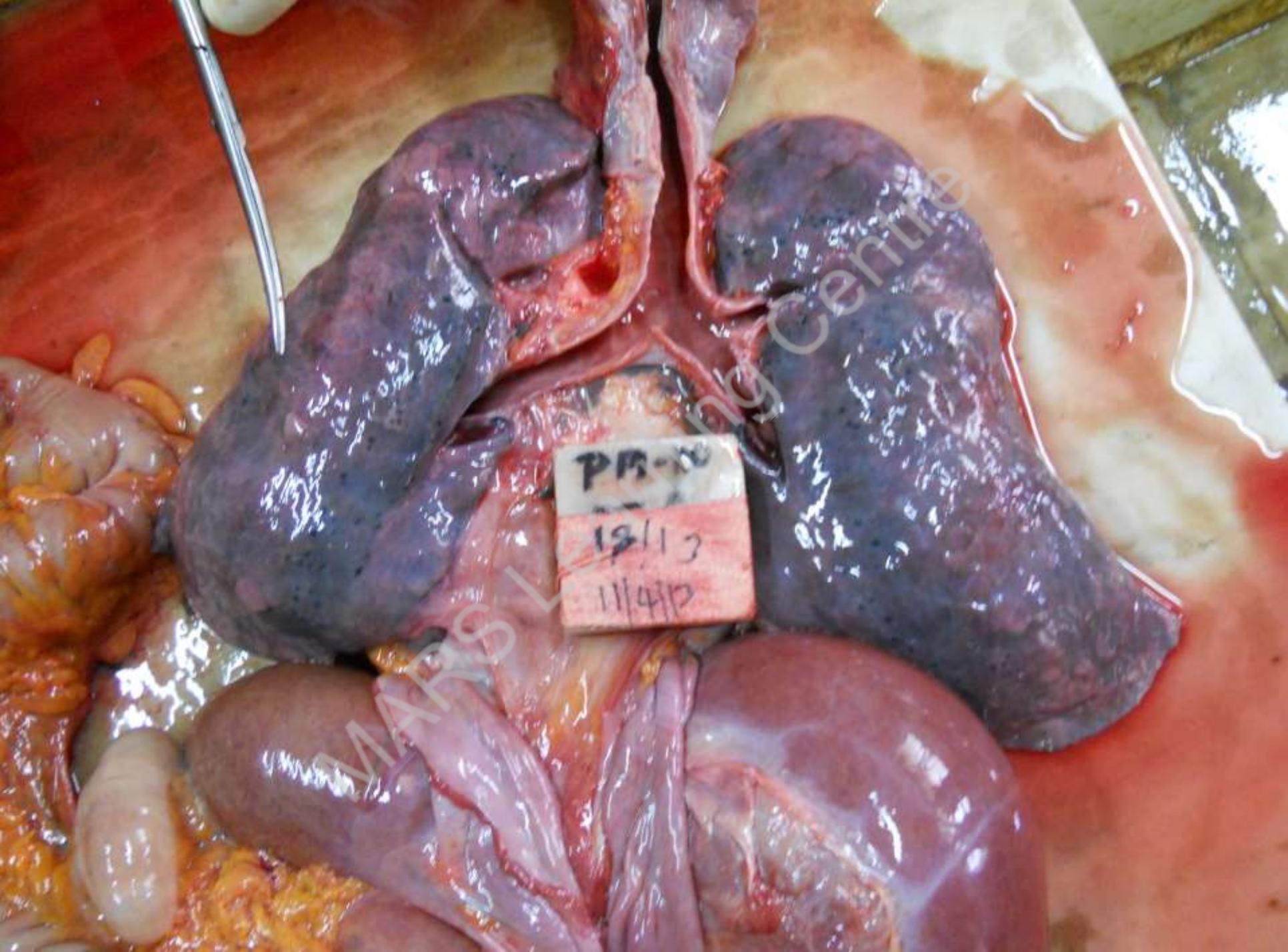
- Lungs: Voluminous, bulky, boggy, greatly distended, waterlogged, doughy and will easily pit on pressure by fingers
- Lungs filling chest cavity and overlapping the heart,
- Lung Ballooning is a characteristic feature, when they bulge out of the chest on removal of sternum
- Indentations of ribs because of pressure

Indentations of ribs



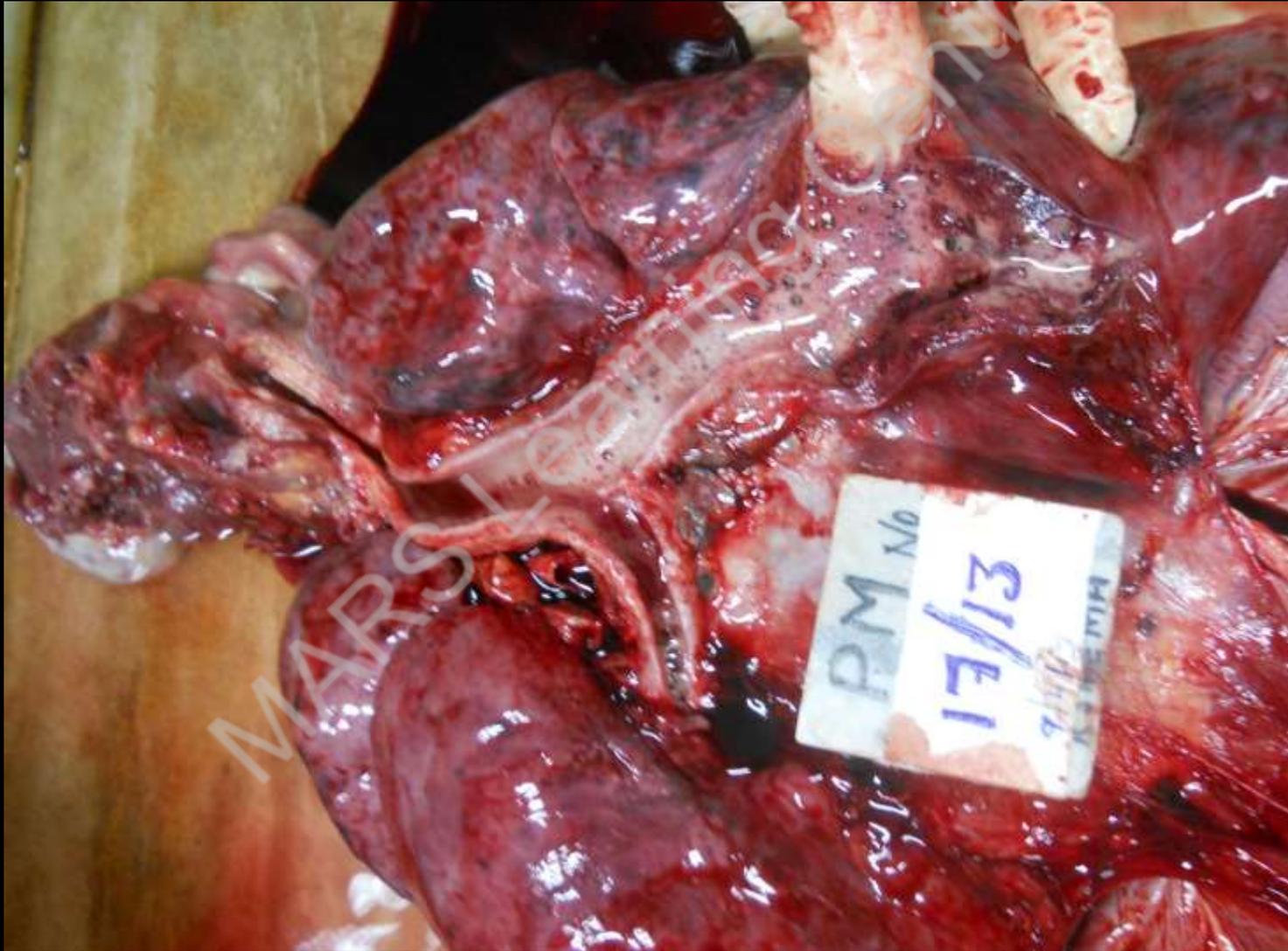


Emphysema Aquosum



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Froth mixed with debris, sand and weeds in-
larynx, trachea & bronchioles

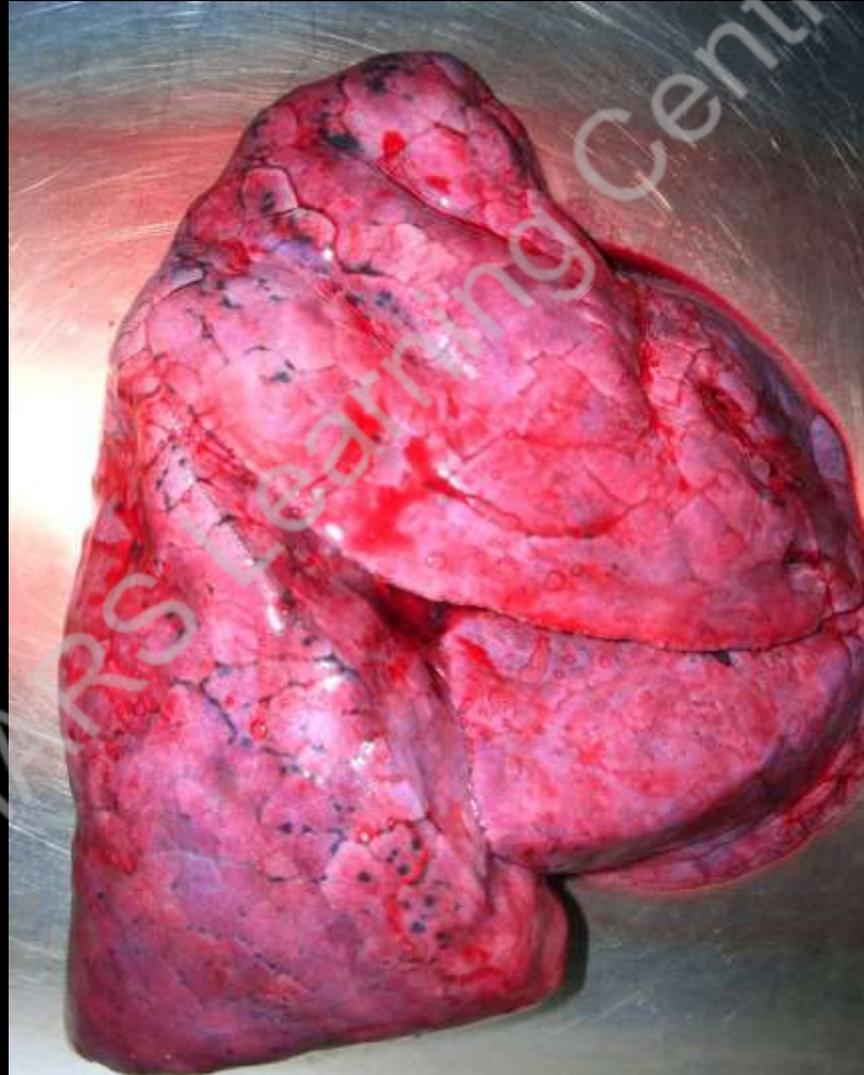




Sand particles in airways



Indentations of ribs



Internal Findings: Lungs....

Paltauf's Hemorrhages :

- Mottled areas of alternate red & grey
- Mostly over the interlobular septa on the anterior surface or margins of the lungs
- Subpleural, alveolar wall haemorrhagic rupture

Paultauf's haemorrhages



- **If a unconscious body will be thrown into water**

Edema aquosum

No violent breathing, froth. Passive entry of water.

- *If a dead body will be thrown into water*

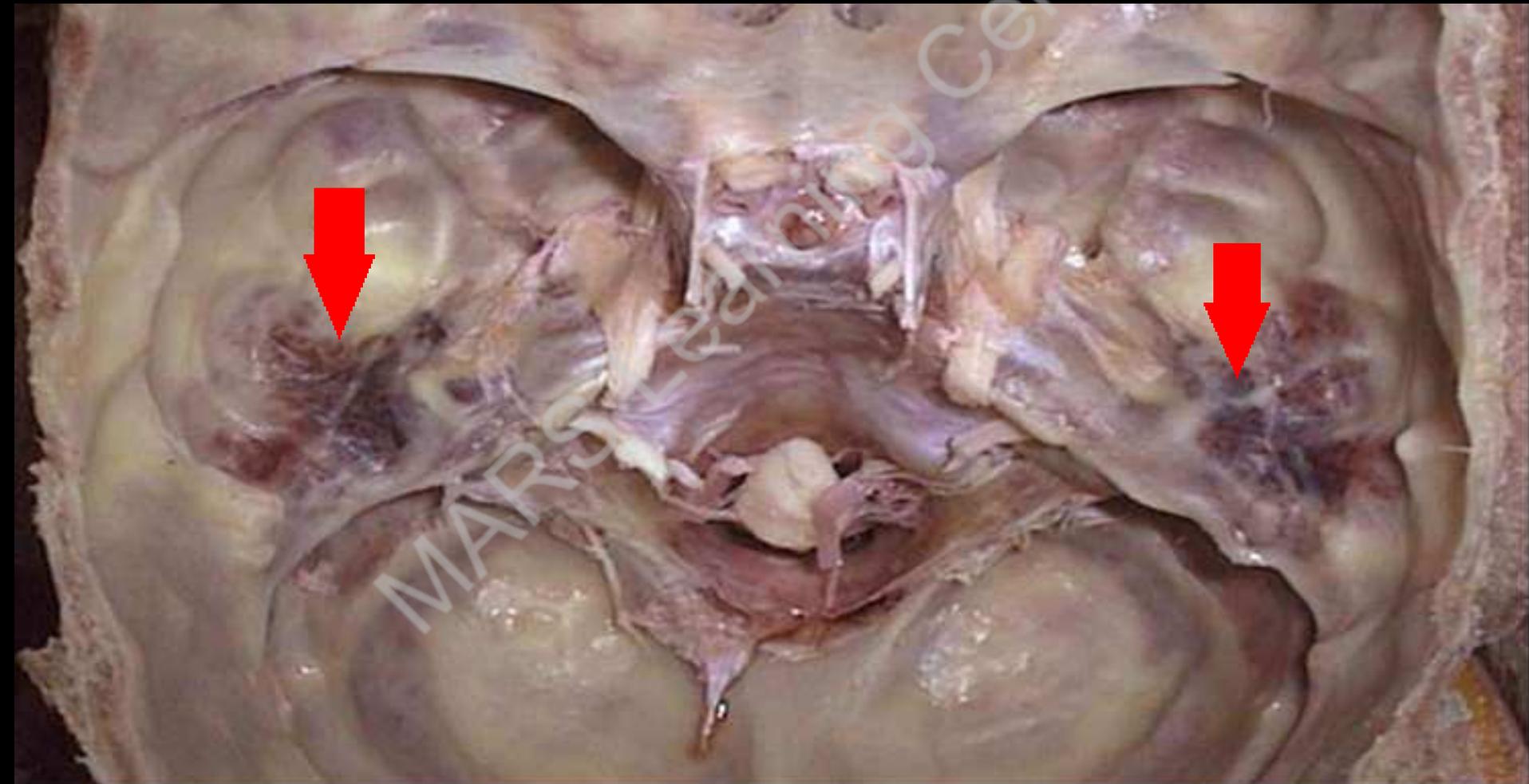
Due to hydro static pressure water passes into the lungs known as ‘Hydrostatic Lung’ which will simulate drowning lung.

Internal Findings...

- Brain, Liver, Kidney etc.- Congested
- Brain oedematous
- Water inside the Middle ear cavity, sphenoid sinus

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Haemorrhages in the middle ear, temporal bone, mastoid sinuses



Svechnikov's sign (Fluid in the sphenoid sinus)



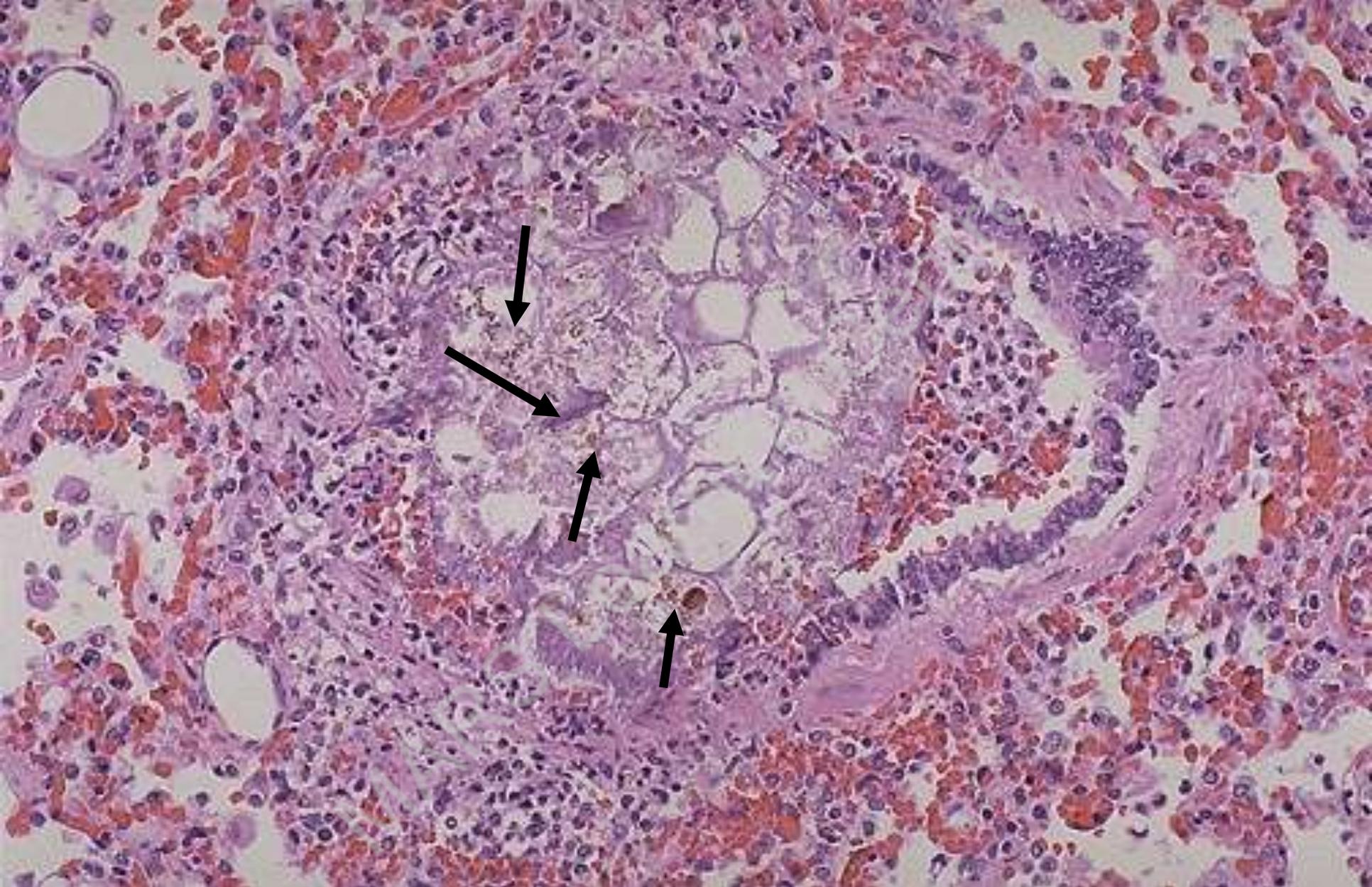
- Within 1-2 weeks peeling off the skin of hands and feet.
- After 2 weeks in temperate condition skin and hair become loose and will begin to detach.



PM No
26-13
K.SHEMA



VIHAR'S Learning Centre



Water planktons in the lung

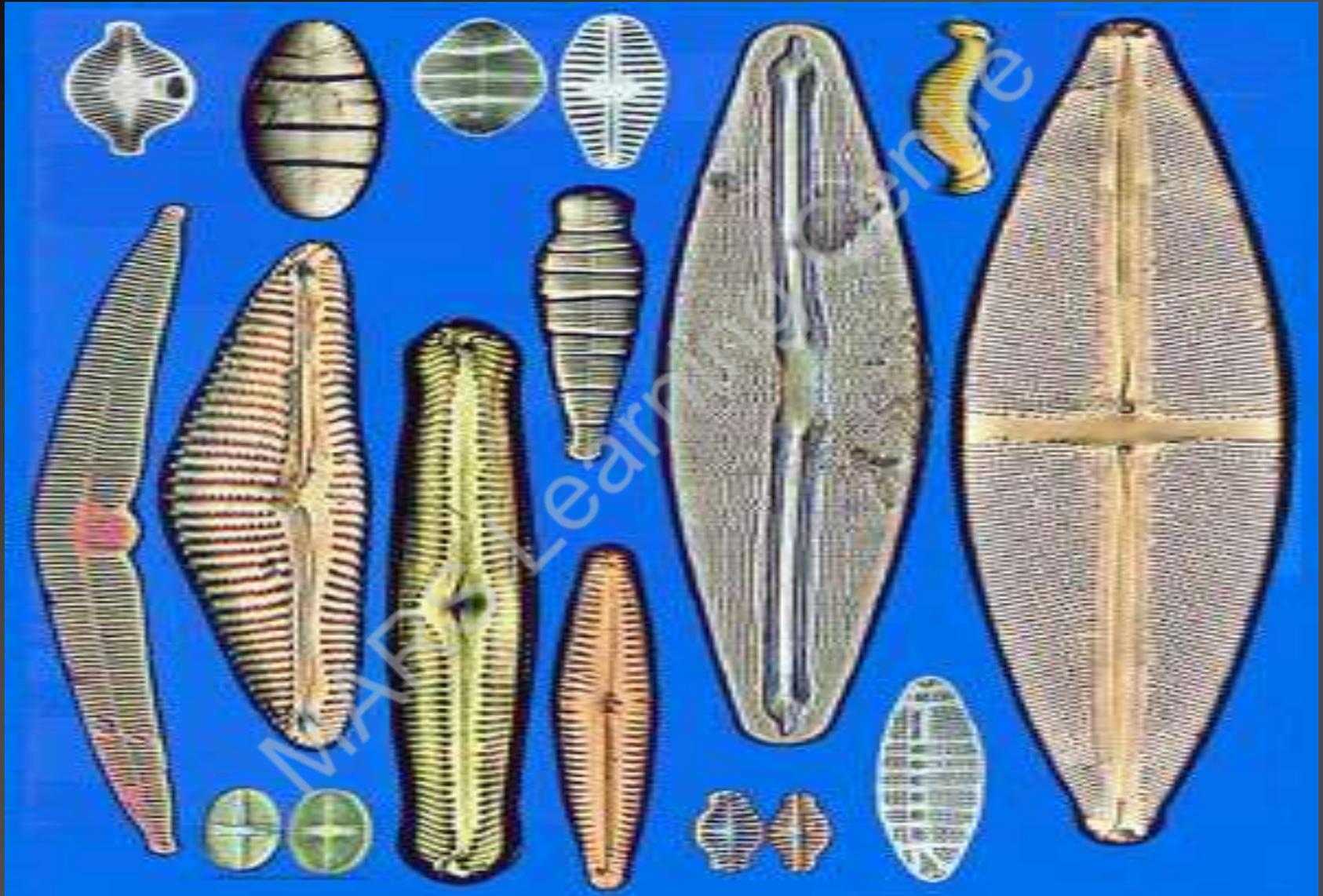
Detection of Diatoms

- **Diatoms** : Unicellular algae with inert silicon coating & hence resist heat & corrosive action.
- Found in all natural water sources especially in stagnant water – pond.
- Water from any sources contains diatoms.

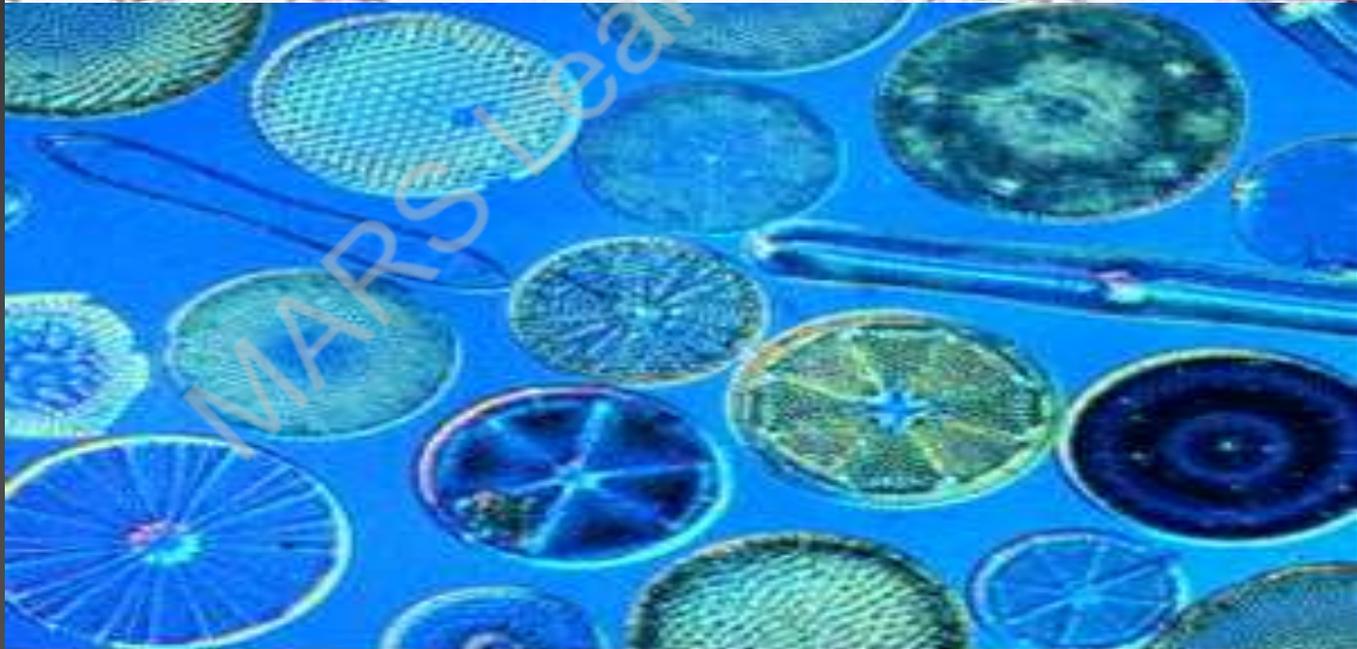
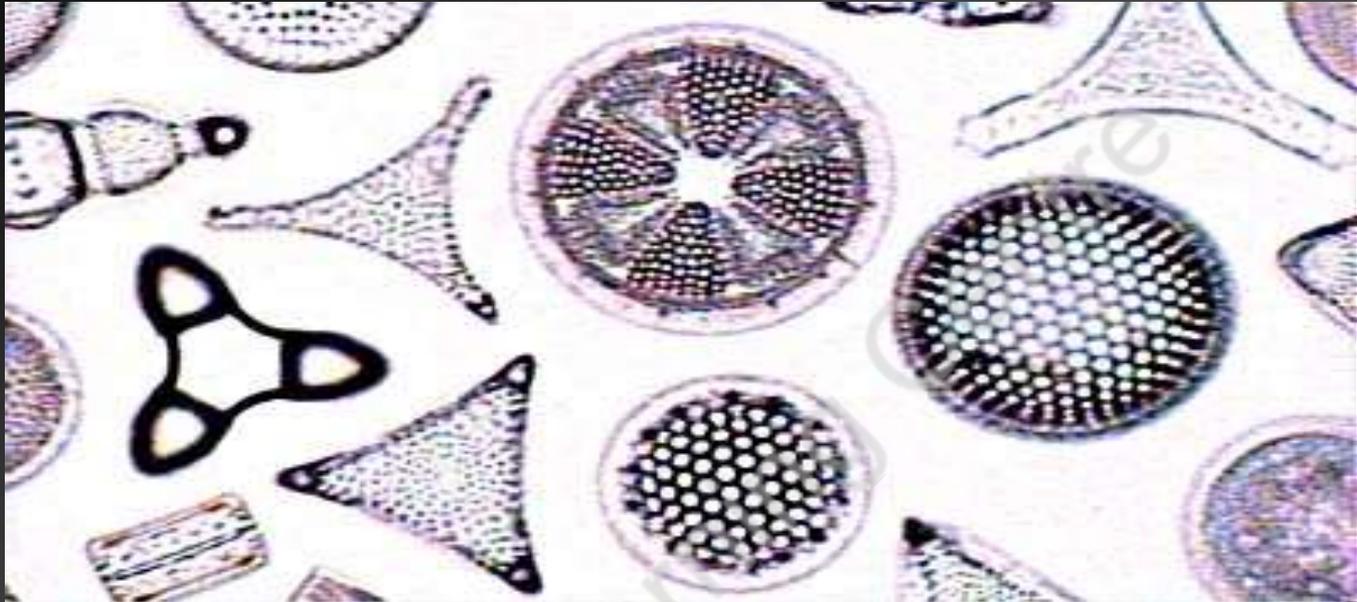
Diatoms



DIATOMS



DIATOMS



LAB. TESTS IN DROWNING (**Diatom test**)

- There are about 15,000 species & the usual size is 10 to 80 microns.

MLI:

- One of the dependable signs of ante mortem drowning.

- During drowning, diatoms pass from the lungs into pulmonary circulation & then enter into systemic circulation.
- In this way, they get deposited in various organs & tissues including brain, liver, bone marrow etc.

Water inhaled into the lungs during Drowning



Diatoms enter lungs



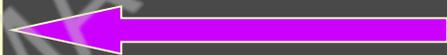
Diatoms penetrate the ruptured alveolar membranes



Enter the blood stream



Left Heart

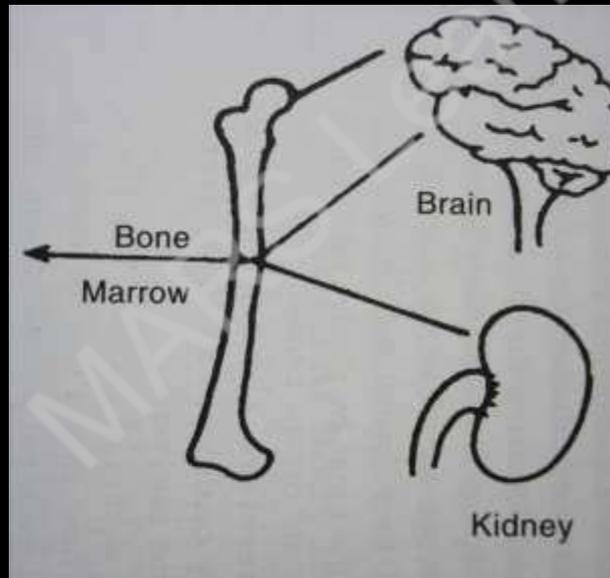
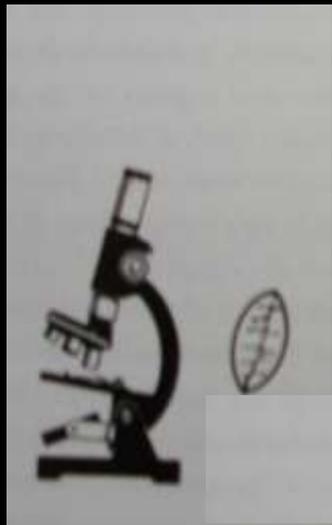
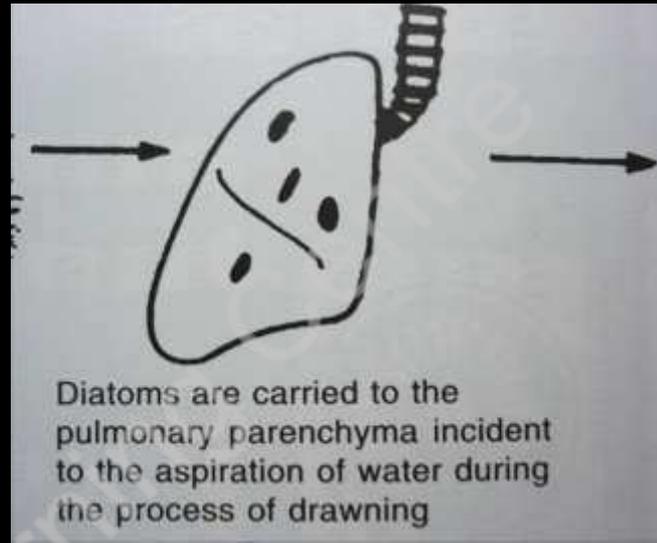
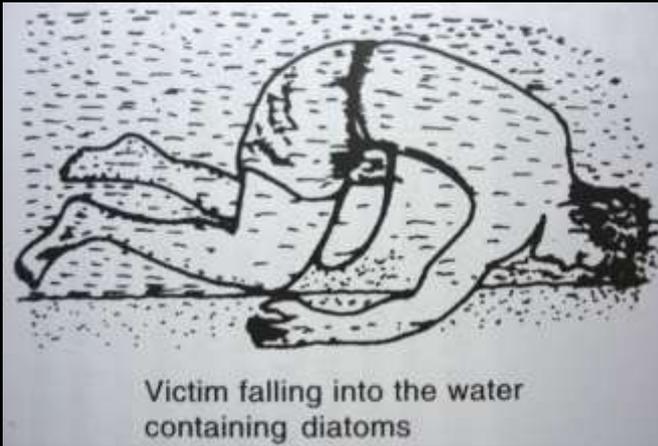


General circulation

Brain
Kidney
Bone marrow
Liver



Diatoms test



Through the alveolar tears diatoms enter blood stream & various organs

Procedure

Take 5 gms. of bone marrow, Kidney, Liver or Brain tissue in a test tube



Add 5 times the volume of conc. Nitric acid



Keep for 2 days- **Acid digestion**



Centrifuge- Discard the supernatant acid & take the deposit.

Examined under Dark ground or Phase contrast microscope

TECHNIQUE

- Most suitable tissue is bone marrow, which can be obtained from sternum or many long bone (eg. Femur).
- The bone is first washed in distilled water.
- Periosteum is removed over a small area & a piece of rectangular bone is cutaway.
- Marrow is scooped out & about 2 to 5 gm of this is boiled in test tube along with 10 ml HNO_3 & 0.5 ml H_2SO_4 for 15 minutes. Sodium Nitrate is added to remove black deposit.
- The material is centrifuged & examined under phase contrast microscope. In positive cases, numerous variously -shaped diatoms will be seen.

PRINCIPLE:

- Demonstration of diatoms in postmortem tissues microscopically suggests death due to drowning.

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DRAWBACKS

- Not applicable in dry drowning.
- Diatoms may be present in tissues. If at any time during life the person had accidentally inhaled a little water.
- Diatoms may also be absorbed from G.I. tract.

M.L.I. : Whether A.M. or P.M. ?

Signs of ante-mortem drowning:

- Froth
- Cadaveric spasm
- Emphysema aquosum
- Water in middle ear, G.I. tract etc.
- Positive diatom test.



- **Accidental**:-Common among non – swimmers (especially intoxicated, epileptic, elderly, infant, etc. Can occur in a well, lake, river or the sea.
- **Suicidal** : - Common in India (Especially among women).
- **Homicidal** :- Rare. A non –swimmer may be pushed into a water, lake, etc, Injuries may be present. Limbs may be tied. Weights may have been attached.

Opinion

WHA (world health assembly) guidelines

Immediate cause

- a) Condition directly leading to death
- b) Condition that precipitating above cause

Contributory cause

Opinion - Samples

- There is nothing to suggest that the deceased died due to any cause other than drowning.
- The deceased died due to pulmonary oedema. Autopsy findings are consistent with the history of drowning

Opinion

Modes of dying should be avoided as they provide no useful information as to the underlying disease process

If at all entered, the disease which led to them must be entered in the next line.



Thank You
Have A Nice
Day