

# ***Asphyxia***

***Dr. Asela Mendis***

# Asphyxia

Mechanical Asphyxia

*"Asphyxia" is a term derived from Greek that literally translates as "stopping of the pulse." This term refers to a multi-aetiologic set of conditions in which there is inadequate delivery, uptake and/or utilization of oxygen by the body's tissues/cells, often accompanied by carbon dioxide retention.*

## Definition:

- Equated with lack of oxygen.
- The words means absence of pulsation.
- Anything that interferes with oxygen transfer can be called asphyxia (hypoxia or anoxia).

# Examples of Asphyxia:

- *Absence or reduction of oxygen tension in the external atmosphere.*
- *Obstruction of the external respiratory orifices.*
- *Blockage of the internal respiratory passages.*
- *Restriction of the respiratory movements or paralysis from brainstem or cord damage or the use of curare-like drugs.*
- *Disease of the lungs that prevents or reduce gaseous interchange.*

- *Reduction in cardiac function leading to impairment of the circulation ( stagnant anoxia ).*
- *Reduced ability of the blood to transport oxygen (co).*
- *Inability of the peripheral tissue cells to utilize the oxygen delivered to them ( cyanide ).*

# Asphyxia

- *Condition of lack of oxygen*
- *Usually obstructive*
- *Any level: nose, mouth... alveoli.*

# Asphyxia

- *Classical Features:*
  - *Congestion*
  - *Oedema of the face*
  - *Cyanosis of the skin of the face*
  - *Peteachial haemorrhages in the skin of the face and eyes.*
  - *Peteachial haemorrhages of internal organs: lungs, pericardium, thymus..*



## Classic signs of Asphyxia:

1. Petechial hemorrhages.
2. Congestion and edema.
3. Cyanosis.
4. Engorgement of the right heart and fluidity of the blood.

# Asphyxia

## *Sequence of events:*

- *Increase efforts to breathe, congestion, cyanosis*
- *Deep respiration, petechiae*
- *Loss of consciousness, possible convulsions, vomiting..*
- *Reduction in breathing, brain damage*

# Petechial hemorrhages:

- *Small pin-point collections of blood.*
- *Rupture of small venules.*
- *Caused by an acute rise in venous pressure leading to over distension and rupture of thin-walled peripheral venules.*
- *Hypoxia of the vein wall is an added factor.*
- *Found in lax tissues and in unsupported serous membranes.*

# Petechial hemorrhages:

- *Found in the skin, sclera, conjunctivae, visceral pleura or pericardium. Also in the forehead, behind the ears and the circumoral skin.*
- *Vary in size up to 2 millimeter.*
- *If larger than this it is called ecchymoses.*
- *Tardieu spots: petechae found in the visceral pleura.*

# Petechial hemorrhages:

- *Venous engorgement may leads to frank bleeding from the nasal mucosa and the external auditory meatus.*
- *In the brain, petechiae occur in the white matter.*
- *Non spesific sign of asphyxia:*
  1. *Post mortem phenomenon*
  2. *Present in congestive deaths*
  3. *In abnormal posture*
  4. *Pigment foci*

# Congestion and oedema:

- *It is the result of obstructed venous return.*
- *It is most notable in the tongue, face, lips, pharynx and larynx above the level of venous obstruction.*
- *The color of congestion is dark pink.*
- *Congestion is associated with tissue swelling if the venous obstruction continues.*

# Congestion and oedema:

- *Edema is the result of transudation through capillary and venule walls.*
- *Hypoxia might be an added factor in edema.*
- *Froth may be profuse in cases of strangulation which emerge from the mouth and nostrils.*
- *Non specific sign of asphyxia.*

# Cyanosis:

- *Cyanosis depends on the absolute amount of reduced hemoglobin, at least 5 gm of reduced hemoglobin per 100 ml blood before cyanosis appears.*
- *Cyanosis follows congestion of the organs.*
- *Cyanosis may be overshadowed by hypostasis.*



# Engorgement of the right heart and fluidity of the blood:

- *Non specific sign of asphyxia.*
- *It is found in any type of congestive deaths.*
- *It is impossible to make a post mortem diagnosis of acute hypoxia by measuring the blood gases.*

# ***Definitions***

# Mechanical Asphyxia:

- **Suffocation:**

Death from deprivation of oxygen in the environment. - Lack of oxygen in the inspired air

- **Smothering:**

blockage of the external air passages by a hand or a soft fabric.

- **Gagging:**

fabric or adhesive tape occludes the mouth while the nasal passages remain patent.

- **Choking:**

blockage of the upper airways by some foreign body.

- **Manual strangulation:**

(throttling) applying neck pressure by the hand.

- **Ligature strangulation:**

applying external pressure to the neck by a ligature (garroting).

- **Mugging:**

applying neck pressure by an arm crooked around from the rear (arm-lock).

- Traumatic asphyxia: restriction of chest movement.
- Postural/positional asphyxia.

# Suffocation

- *Accumulation of irrespirable gas*
- *Deep tanks, ships, deep wells..*
- *Plastic bag on head*
- *Manner:*
  - *Accidental (common)*
  - *Suicidal*

# Suffocation:

- *Reduction of oxygen concentration in the respired atmosphere.*
- *Found in decompression chambers, effect of partial vacuum and near explosive situation.*
- *Physical replacement of other gases or chemicals.(co, co<sub>2</sub>, cyanide.....)*
- *Children may asphyxiate by being trapped in a small air-tight space.*

# Suffocation:

- *Rapid death is common before hypoxia can have had any physiological effect.*
- *Cause of death is over stimulation of the chemoreceptor system, leading to a parasympathetic (vasovagal) cardiac arrest.*
- *Classic signs of asphyxia are almost always absent.*
- *Autopsy findings are negative*



# Plastic bag suffocation:

- *Manner of death: suicide or homicide or accidental.*
- *It can be rapid and leave no signs of asphyxia.*
- *Mechanism of death: cardio-inhibitory rather than hypoxic.*

# *Smothering*

*The nose and/or mouth and/or upper pharynx are occluded by an object or body part in such a way that adequate breathing cannot occur. Examples include a pillow or hand over the nose and mouth, a gag, and a head encased by a plastic bag.*

# Smothering

- *With a pillow or hand pressed over nose and mouth*
- *Sings of asphyxia can be minimal: old age, infants*
- *Sings of struggle: injuries on the face*
- *Manner:*
  - *Suicidal*
  - *accidental*

# Smothering:

- *Mechanical occlusion of the mouth and nose.*
- *The smothering agent is a fabric or a hand.*
- *Manner of death: homicidal or accidental in cases of infants.*
- *Sudden infant death syndrome. (cot deaths)*

# Smothering:

## Autopsy findings:

- *Multiple oval or semi lunar bruises*
- *Abrasions around the mouth and nostrils*
- *Circumoral area of pallor*
- *Examination of the mouth*

# Overlaying of infants:

- *Infant found dead in the morning in the maternal bed.*
- *SIDS*

# Gagging

- *Cloth or soft object in the mouth.*
- *Person can breathe from nose, but if secretions accumulate in the nose and pharynx, asphyxia can happen*
- *Manner:*
  - *Accidental*
  - *homicide*

# Gagging:

- *Fabric or adhesive tape occludes the mouth while the nasal passages remain patent.*
- *Similar situation arises when a gag is thrust into the mouth.*
- *Obstruction is due from saliva and mucus or moving of the gag backwards into the nasopharynx.*



# Choking

- Obstruction of the upper airway by object in the pharynx or larynx
- Food, toys, dentures
- Manner:
  - Accidental
- Increased risk in:
  - Sedation
  - Anesthesia
  - Alcohol
  - Drugs
  - Mental disease

# Choking:

- *Blockage of the internal airways between the pharynx and the bifurcation of the trachea.*
- *Cause of death: pure hypoxia from occlusion of the airway (signs of asphyxia).*
- *Or: neurogenic cardiac arrest which may be accelerated by excess catecholamine release from the adrenaline response.*

# Choking:

## Causes:

- *Foreign bodies*
- *Dentures and hemorrhage*
- *Acute obstructive lesions*
- *Food material*
- *Inhalation of irritant fumes (chlorine in swimming pools)*

# Traumatic Asphyxia

- *External pressure preventing respiration*
- *Signs of asphyxia*

## *Traumatic asphyxia:*

- *Acts by restricting respiratory movements and thus prevents inspiration.*
- *Manner of death: accidental or homicidal (burking).*
- *Classic signs of asphyxia are marked.*

# Traumatic asphyxia

- Autopsy findings:
- *External: signs of asphyxia and line of demarcation*
- *Internal: signs of asphyxia and the lungs are usually dark and heavy*

# Traumatic asphyxia

## *Mechanism of asphyxia:*

*Pressure on the chest forces blood into the great veins and as the venous valves in the subclavian vessels prevent displacement into the arms, the extra volume is forced up the valveless jugular system to congest the head and neck.*

# Postural asphyxia:

- *When a person remains in a certain position for an extended time.*
- *In trapped persons, drunken*
- *The normal venous return to the heart may be impaired*



# Postural asphyxia

- *Positions are inversion either of the whole body or the upper half*
- *Inversion may occur during torture: crucifixion has an element of postural asphyxia as inspiration would be impeded by the weight of abdominal viscera upon the diaphragm.*

Fatal pressure on the neck

# Pressure on the Neck

- *Manual strangulation*
- *Ligature strangulation*
- *Hanging*

## ***Strangulation:***

***It is a form of asphyxia caused by constricting the neck by any means other than body weight.***

***Constricting force being hands- in throttling; elbow- in mugging; knee, foot- bansdola; some hard object.***

# Pressure on the Neck

## *What happen:*

- *Obstruction of jugular veins, congestion, cyanosis*
- *Obstruction of carotid artery, cerebral ischemia*
- *Stimulation of baroreceptors in carotid sinus, vagal effect on heart*
- *Closing airway at pharynx by the tongue and larynx*
- *?? Close airway at trachea level*

# ***Manual Strangulation***

# *Manual Strangulation*

- *Pressure on neck by single for both hands*
- *Common mode of homicide*
- *Man against woman or child*
- *Abrasion, bruises on neck*
- *Injuries of neck soft tissue*
- *? Bleeding into posterior neck tissue can be normal at autopsy*

# *Manual strangulation*

- *Common method of homicide*
- *Seen in domestic homicides, in sex related murders and in child killings.*



# Autopsy in manual strangulation

## ○ Bruises:

- discoid (from finger-pads)*
- 1 to 2 cm in size*
- cluster at the sides of the neck*
- under the angles of the jaw*
- fresh (dark red or purple)*
- superficial raised heamatomas*

# Autopsy in manual strangulation

## ○ Abrasions:

*-from assailant or victim*

*-fingernails abrasions*

*-along the margin of the jaw line*

*-straight or curved*

*-fingernail scrapings should be taken (victim and assailant)*

## *External findings other than in neck*

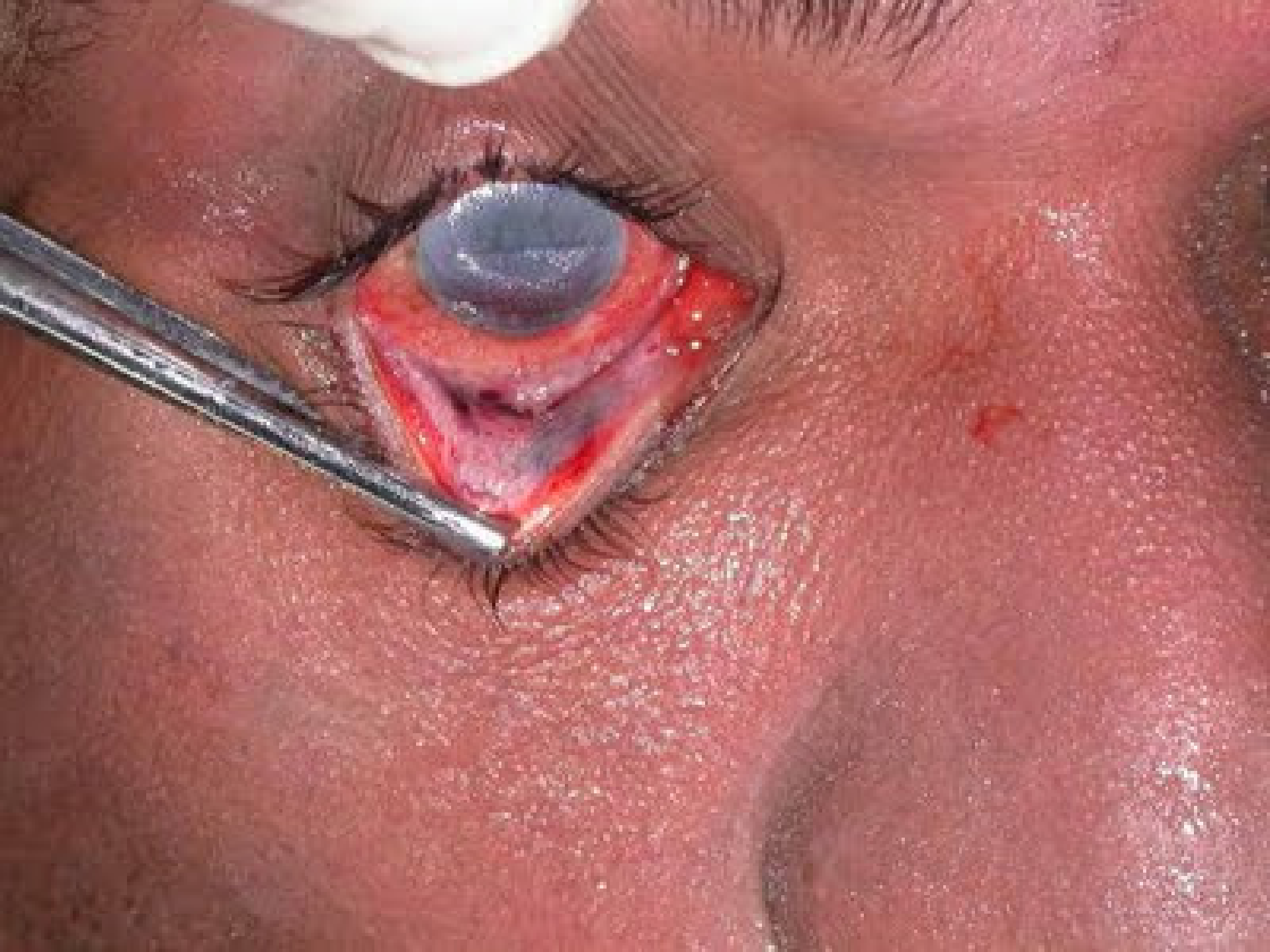
- *Signs of asphyxia.*
- *Face- swollen, cyanosed & marked with petechial haemorrhages.*
- *Eyes- prominent, conjunctiva injected and pupils dilated.*
- *Lips- blue.*
- *Bloody froth from mouth, nose & ears.*
- *Tongue- swollen, bruised & bitten by teeth.*
- *Hands- clenched.*
- *Urine, feces and semen may be discharged.*
- *There may be injuries on chest*













# Internal appearances in manual strangulation

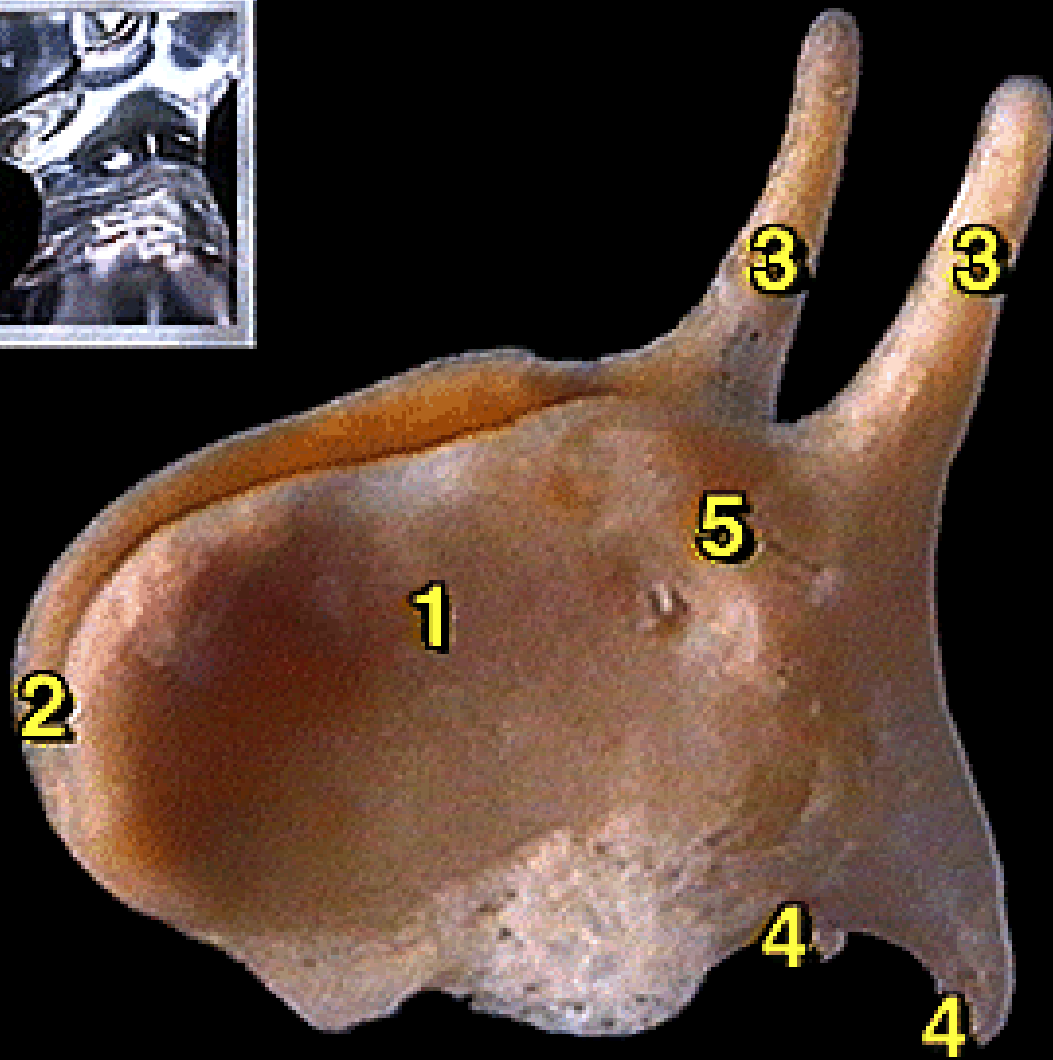
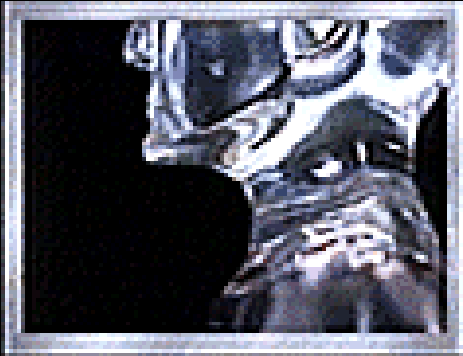
- *Bruises in the neck tissues*
- *X-ray to determine the state of the laryngeal cartilages*
- *Injury of the carotids*
- *Fracture of the thyroid or hyoid horns*



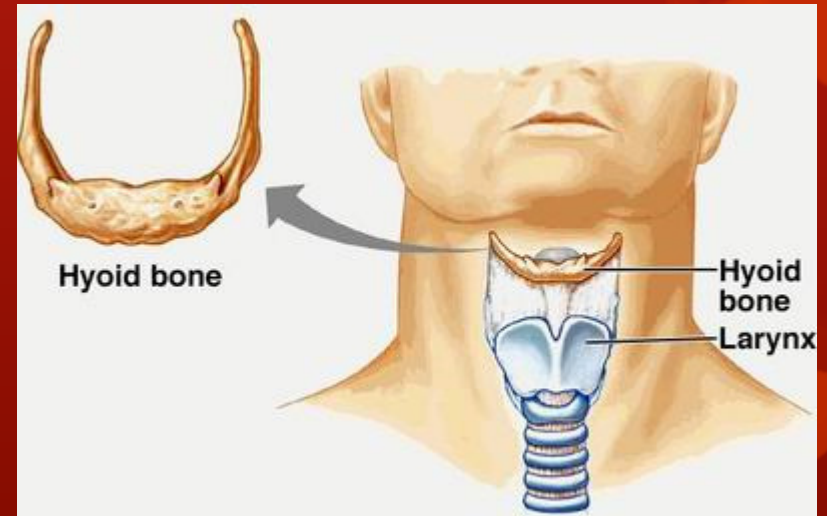


## *Results of manual strangulation using hands*

- *Typically, manual strangulation fractures the cornu of the thyroid cartilage*
- *Even more common in manual strangulation is hemorrhage of muscles in neck*



*In manual strangulation, fracture of hyoid bone in neck is infrequent, and seen in elderly women who have osteoporosis, which makes fracturing the bone easier*



# Manual strangulation

## ○ *Possible Mechanisms of death:*

*-obstruction of the airways*

*-reflex cardiac arrest*

*-cerebral ischemia*

- ***Throttling or Manual Strangulation:***
- ***Marks of fingers & thumb on either side of neck***
- ***Look like bruises soon after death***
- ***There may be bruises on mouth, nose, cheeks, forehead and lower jaw.***



# ***Ligature Strangulation***

## ○ Causes of death in strangulation:

- Asphyxia
- Vasovagal inhibition
- Cerebral congestion
- Combination of above factors

# *Ligature Strangulation*

- *Constricting band in tightened around the neck*
- *Manner:*
  - *Homicide*
  - *Accidental*
- *Signs of asphyxia: marked congestion, cyanosis, and petechiae*
- *Rope, wire, cloth..*
- *Ligature mark: usually above the laryngeal prominence*
- *Look for knots, cross over point*

## ***External findings***

### ***Neck findings***

- ***Fragments of epidermis on suspected ligature material, if found.***
- ***Usually on or below thyroid cartilage.***
- ***Encircle the neck completely***
- ***Bruising & ulceration at the site of knot***

## ***Internal findings***

***Extravasation of blood into subcutaneous tissue above and below the ligature mark. Laceration of the superficial muscles of neck.***

***Fracture of hyoid bone, tracheal rings and cervical vertebrae.***

***Lungs- dark, frothy blood on section***

***Heart- right side full of dark blood and left empty***

***All abdominal organs are congested.***

## ***Ligature strangulation***

- ***Manner of death:***
  - ***Homicidal***
  - ***Accidental***
- ***Possible mechanisms of death:***
  - ***obstruction of the airways***
  - ***reflex cardiac arrest***
  - ***cerebral ischemia***

# Ligature strangulation

## ○ *Ligature mark*

*-deeply imbedded in the skin*

*-edema of the tissues above the ligature*

*-skin mark may be red*

*-narrow zone of reddened hyperemia at either margin of the mark*

*-position of the ligature (encircle the neck horizontally at a lower level)*



















Department of Forensic Medicine & Toxicology, Faculty of Medicine Colombo

MEASUREMENTS IN METERS

PME  
Case No :  
**17823/AM**

Department of Forensic Medicine & Toxicology, Faculty of Medicine Colombo

INCHES



Department of Surgery, Medicine & Obstetrics, Faculty of Medicine, Columbia University, College of Physicians & Surgeons

NAME

Case No.:

1823/AM

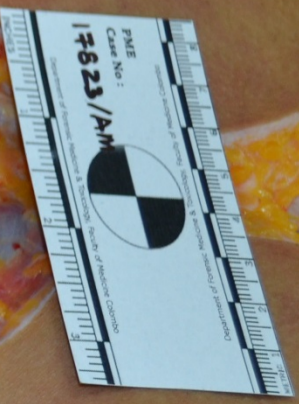
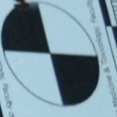


Department of Surgery, Medicine & Obstetrics, Faculty of Medicine, Columbia University, College of Physicians & Surgeons



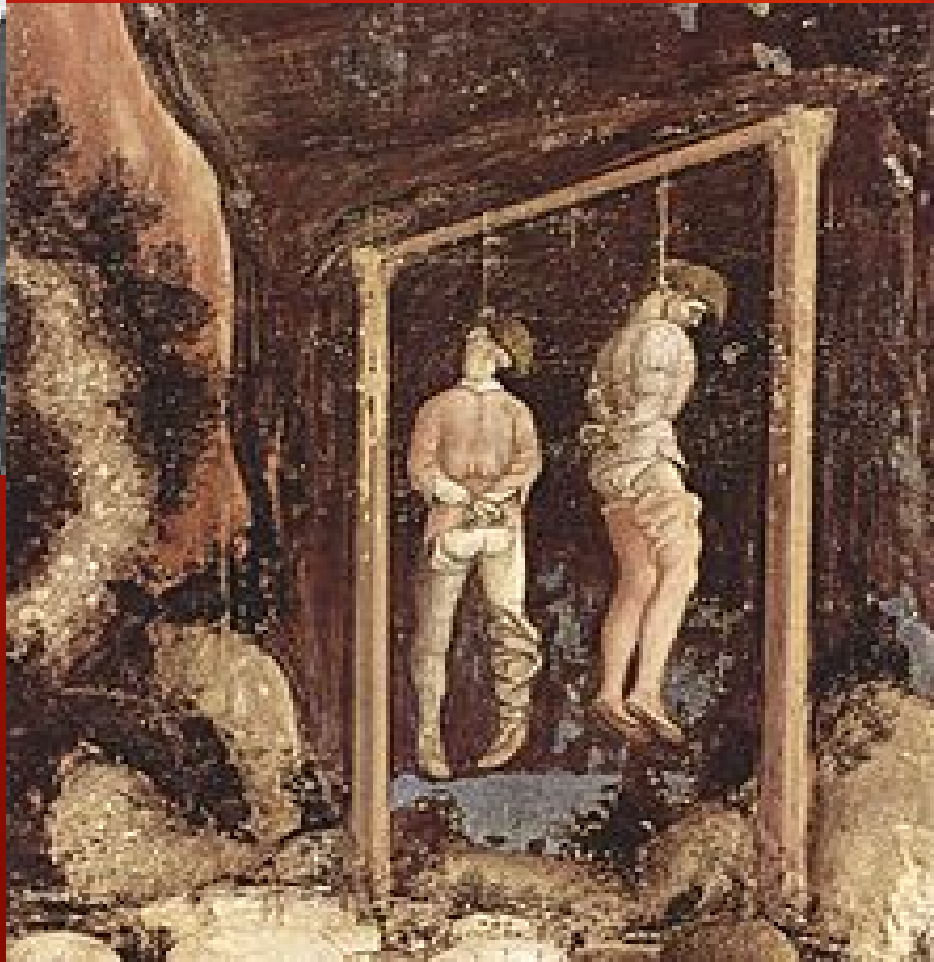


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# *Hangings*



*Hanging is a form of strangulation where a noose is pulled tight around the neck by the person's own body weight. The noose compresses the airways, cutting off the supply of oxygen to the lungs. It also compresses the carotid arteries, which carry blood to the brain. Both mechanisms cause asphyxia, in which body and brain are deprived of oxygen.*

*Most adult hangings are suicides. In children, hanging may occur by accident if they get themselves tangled up in clothes or a harness. Homicidal hanging is very rare and the generally the victim needs to be unconscious or intoxicated for such an act to occur.*

# *Hanging*

- *Self-suspension*
- *Need not to be from high point*
- *Can be in sitting or kneeling*
- *Weight of the body is enough to cause pressure on the neck*
- *Signs of asphyxia*
- *Suspension point*
- *Manner:*
  - *Suicide in male*
  - *accidental*

➤ *It is a form of asphyxial death brought about by suspension of the body and constriction of neck by a ligature around it.*

*Two types of Hanging;*

➤ *Complete hanging/typical- when feet don't touch ground*

➤ *Partial hanging/atypical- when the feet touch ground*

## *Hanging*

- *Force applied to the neck*
- *Gravitational drag*
- *Weight of the body or part of the body*



## ***Mechanism of death:***

- ***Airway occlusion***
- ***Occlusion of the neck veins***
- ***Compression of the carotid arteries***
- ***Nerve effects: (carotid sinus and sheath)***
  - ***Afferent: glossopharyngeal nerve to the tenth nucleus in the brain stem.***
  - ***Efferent: return via the vagus supply to the heart.(parasympathetic)***
- ***-2 possible mechanisms on the heart.***

## *Mechanism of death;*

- *Cerebral ischemia (3-11 seconds)*
- *Congestive death*
- *Spinal cord-brainstem disruption*

# *Causes of death in Hanging:*

- *Asphyxia*
- *Cerebral congestion or congestive suboxia*
- *Vasovagal inhibition or shock*
- *Injury to spinal cord*
- *Combination of the above causes.*
-

# MLA of cardiac arrest (vagal)

- *Sudden unexpected deaths*
- *Death occur rapidly without any signs of asphyxia*
- *Intent of the assailant*
- *Time passed from start of pressure to death*

## ***MLA of cardiac arrest (vagal)***

***Other causes:***

- 1. Blows to the neck (commando punch)***
- 2. Blows to the larynx***
- 3. Impaction of food in the larynx***
- 4. Cold water in immersion***
- 5. Blows to the testicles***
- 6. Dilatation of the uterine cervix***
- 7. Blows in the epigastrium***

# *Hanging*

## *Manner of death:*

- *suicidal*
- *homicidal*
- *accidental:*
  - *During play*
  - *At place of work*
  - *Sexual asphyxia*

*An autopsy of a hanged body will often reveal neck markings. The nature of these depends on the type of noose. Few or no marks may be found with a noose made of a soft material like bed sheets. A rope or cord noose will, however, leave a deep furrow, often with accompanying abrasions and contusions*

*Suicidal hanging: the rope rises to a point, leaving a gap in the ligature mark – the suspension point – on the neck.*





## *Course of direction:*

- *Oblique & interrupted at place-usually of knot*
- *Circular- if suspension is in front*
- *Oblique & circular- if ligature is passed around the neck more than once.*

*The spiral weave of the rope can be seen in this horizontal ligature mark caused by hanging*



## ***Post-mortem findings:***

### ***Nature of ligature:***

- ***Type of the ligature – soft, firm, width etc.***
- ***Time, the body has remained suspended***
- ***Intervention of clothes, beard, skull hair etc.***

## ***Position:***

- ***Above thyroid cartilage- 80%***
- ***On the thyroid cartilage- in cases of partial***
- ***Below thyroid cartilage- very rare***

***Hanging from a high suspension point leaves diagonal marks on the neck like an inverted V, which do not run around the full circumference of the neck. The point where the noose meets the vertical part of the rope is pulled up and away from the body and does not leave a mark on the neck.***

*However, in a hanging from a low suspension point, the marks on the neck tend to be horizontal rather than diagonal and may look more characteristic of a manual strangulation.*



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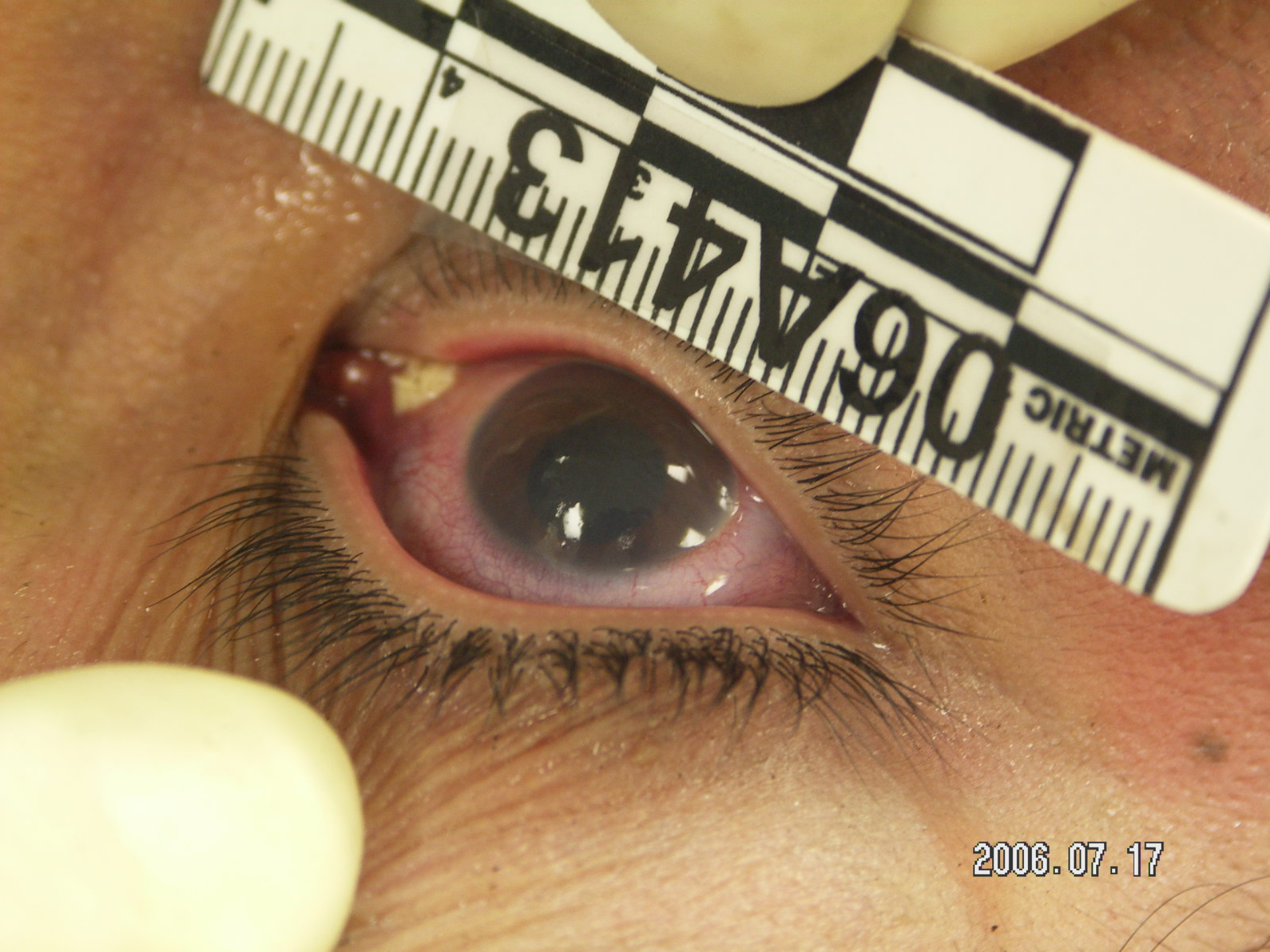


METRIC 06A413

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## ***Colour:***

- ***Pale in early period-later on becomes yellowish & brown then dark brown or chocolate colored.***



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***External appearances other than ligature mark:***

- ***Neck- stretched & elongated, bend to side opposite the knot***
- ***Face- swollen & blue***
- ***Eyes- protruded, dilated pupils, conjunctivae congested***
- ***Tongue- protruded, saliva dribbling from the corner of mouth***

- *Head & neck- petechial hemorrhage*
- *Nails- blue*
- *Sometimes face become pale & eyes and tongue less protruded in case of arteries and veins are compressed together*
- *Genitals- swollen & congested*
- *Rigor mortis- slow and longer*
- *PM lividity- on dependent parts e.g. extremities, breasts, penis & testicles.*

## ***Internal appearance:***

- ***Spinal cord injuries***
- ***Transverse tear of the intima of the carotid arteries & extravasation of blood within the wall***
- ***Pons and medulla may be injured***
- ***Sternocleidomastoid and platysma may be ruptured***
- ***Thyroid cartilage may be fractured***
- ***Heart, right side full of dark blood & left empty***
- ***Abdominal organs congested and bladder empty***
- ***Hyoid bone may be fractured in above 40 age group.***



## ***ML Aspects:***

- ***Most commonly, it is suicidal***
- ***More common in females than males***
- ***Direction of ligature mark***
- ***Oblique-suicidal***
- ***Circular- homicidal***
- ***Presence of poison in body suggest suicide***
- ***Signs of struggle suggest homicide.***

## *Judicial hanging:*

- *severe mechanical disruption of the neck structures*
- *dislocation of the cervical spine*
- *traction on the spinal cord*
- *spinal cord or brainstem disruption (damage)*
- *cerebral function ceased immediately and heart continued to beat up to 20 minutes until hypoxia caused death.*

*In judicial execution by hanging, the body usually drops several feet, which causes disruption of the cervical vertebrae, which are the spinal bones in the neck. The cause of death, if the execution is correctly carried out, is disruption of the spine rather than asphyxia. Fractures of the cervical vertebrae are not often seen in suicidal, homicidal, or accidental hangings, unless the body has dropped through some distance.*

# *Hanging*

## *Methods of hanging*

### *Hanging marks:*

*-suspension point*

*-complete or incomplete circles (split knot or fixed knot)*

*-impression of the knot*

*-abrasions*

*-narrow red zone around the ligature mark*

*-situated high up on the neck*

## ***Investigation:***

### ***Scene Visit: -***

- ***place – house, room, outside etc...***
- ***Accessibility - room locked within***
- ***Whether the scene is disturbed or not  
– evidence of a second person in the  
scene***
- ***Suspension point – is it accessible?***

## ***Suspension point –***

- ***evidence of self suspension- objects used to reach the suspension point.***
- ***Fingerprints***
- ***Type of knot***
- ***Any mechanism used to tie the knot or reach the suspension point***

## ***Noose/Ligature:***

- ***Type – availability***
- ***Knot used to tie the noose around –  
running noose or fixed knot***

***Position of the body:***

***Partial or complete suspension***

***Compatibility of the noose and ligature  
with the position of the body***

***Presence of hypostasis – is it compatible  
with the position of the body***



***Autopsy findings:***

***Interpretation of ligature mark – multiple rounds, position, ad direction.***

***Nail marks in the neck – self inflicted or assailants? Self infliction is possible during the agonal period.***

***Other injuries.***

***Toxicology – evidence of intoxication and incapacitation.***

***Body measurements:***

***height***

***length of the upper limb***

***length of the feet***

***to determine the accessibility***

***Compare with the scene findings  
and measurements.***

*Special neck dissection is a must –  
prinsloo –gordon technique.*

