



Asphyxia

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Definition

- Exactly the word asphyxia means 'absence of pulsation', yet it is commonly used to describe a range of conditions of lack of oxygenation either partial (hypoxia) or absolute (anoxia).

Classification of asphyxia

I. According to the etiology:

A. Pathological: as angioneurotic edema of the glottis, paralysis of brainstem or cord damage, poliomyelitis, ect.....

B. Poisonous: central as in opiates or barbiturates or peripheral as in strychnine.

C. Violent or mechanical interference with respiration, due to:

- Obstruction of respiratory orifices (smothering)
- Obstruction of internal airways (choking)
- Obstruction of respiratory passages in the neck (strangulation, hanging or throttling)
- Interference with respiratory movements (traumatic asphyxia)
- Drowning

II. According to the mechanism:

A. Anoxic Anoxia:

1. Ambient (due to decrease oxygen content in the atmosphere) e.g. High altitude or irrespirable gases(CO₂, N₂, ect)
2. Central (due to depression of respiratory center) e.g. central depressants as barbiturates)
3. Peripheral (due to paralysis or spasm of respiratory muscles) eg. Overdose of succinyl choline or curare, Botulism, OPP
4. **Mechanical (violent asphyxia)**

B. Anemic Anoxia: Decreased oxygen carrying capacity of blood due to:

1. Abnormal hemoglobin (as COHb in CO poisoning)
2. Hemolysis (e.g. Incompatible blood transfusion, Naphthalene or Arsenic intoxication and Viper envenomation).

C. Stagnant Anoxia: Interference with the flow of blood to the tissues as in advanced heart failure, RCI, anaphylactic shock, ect....

D. Histotoxic Anoxia: It is diminished ability of cells to utilize oxygen as in cyanide poisoning or cold exposure.

The Classical Stages of Asphyxia :



A person with obstructed air entry will show phases of distress and physical signs as listed below:




1- Stage of dyspnea: Lack of oxygenation increase the level of reduced hemoglobin in the blood with resulting stimulation of the respiratory center. Clinical picture:

Forced respiration with increased rate and depth.

Facial congestion and the onset of cyanosis.



2- Stage of convulsions: Cerebral irritation due to anoxia and hypercarbia.

- Clinical picture: increased cyanosis and constricted pupils. Generalized convulsions → increase in blood pressure and rupture of sub mucous and sub serous capillaries and appearance of petechial hemorrhages. Also, convulsions increase the intra-alveolar pressure resulting in ruptures of the superficial unsupported alveoli of the lungs called Silvery spots.
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- 3- Stage of paralysis: irreversible brain damage Clinical picture:
- Loss of consciousness
- Irregular breathing (Chyne-stocks) breathing
- Deepening of cyanosis
- Drop of blood pressure
- Muscle relaxation (evacuation of bladder and vomiting)
- Dilated fixed pupils
- Death occurs in about 5 minutes.

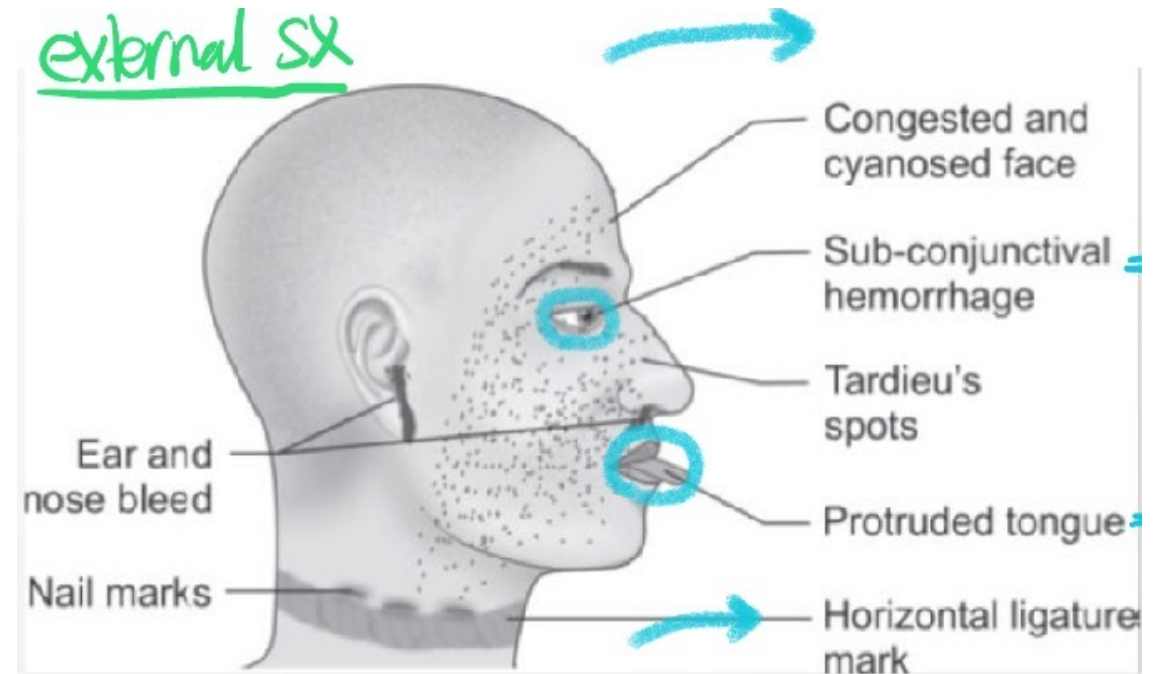
NB. At any stage through this progression, death may occur from cardiac arrest.



The Classical Signs of Asphyxia:

A. External Signs:

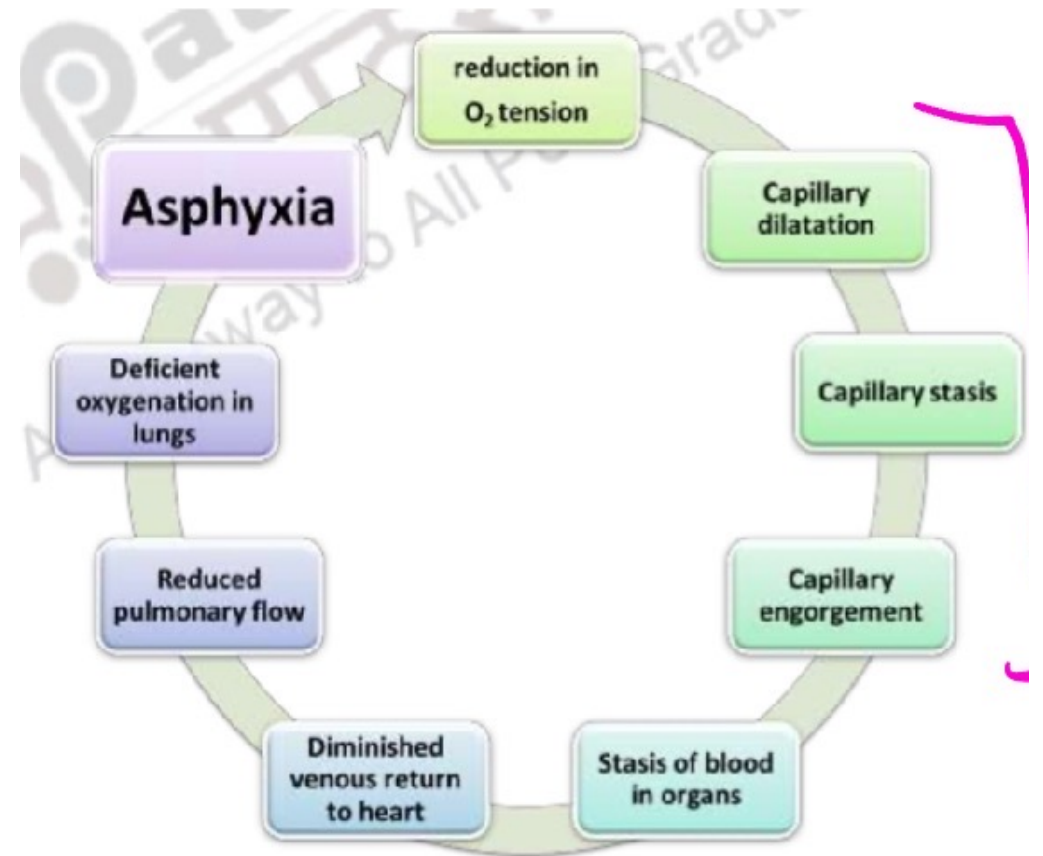
- 1. Cyanosis: dark blue discoloration (lips and nails) depends on the absolute amount of reduced hemoglobin, rather than the proportion of reduced hemoglobin to oxyhemoglobin.
- 2. Facial edema with petechial hemorrhages.
- 3. Prominent eye balls (retro-orbital edema) with subconjunctival hemorrhage.
- 4. Protruded tongue and bloody froth from the mouth and nostrils.
- 5. Dark blue hypostasis.



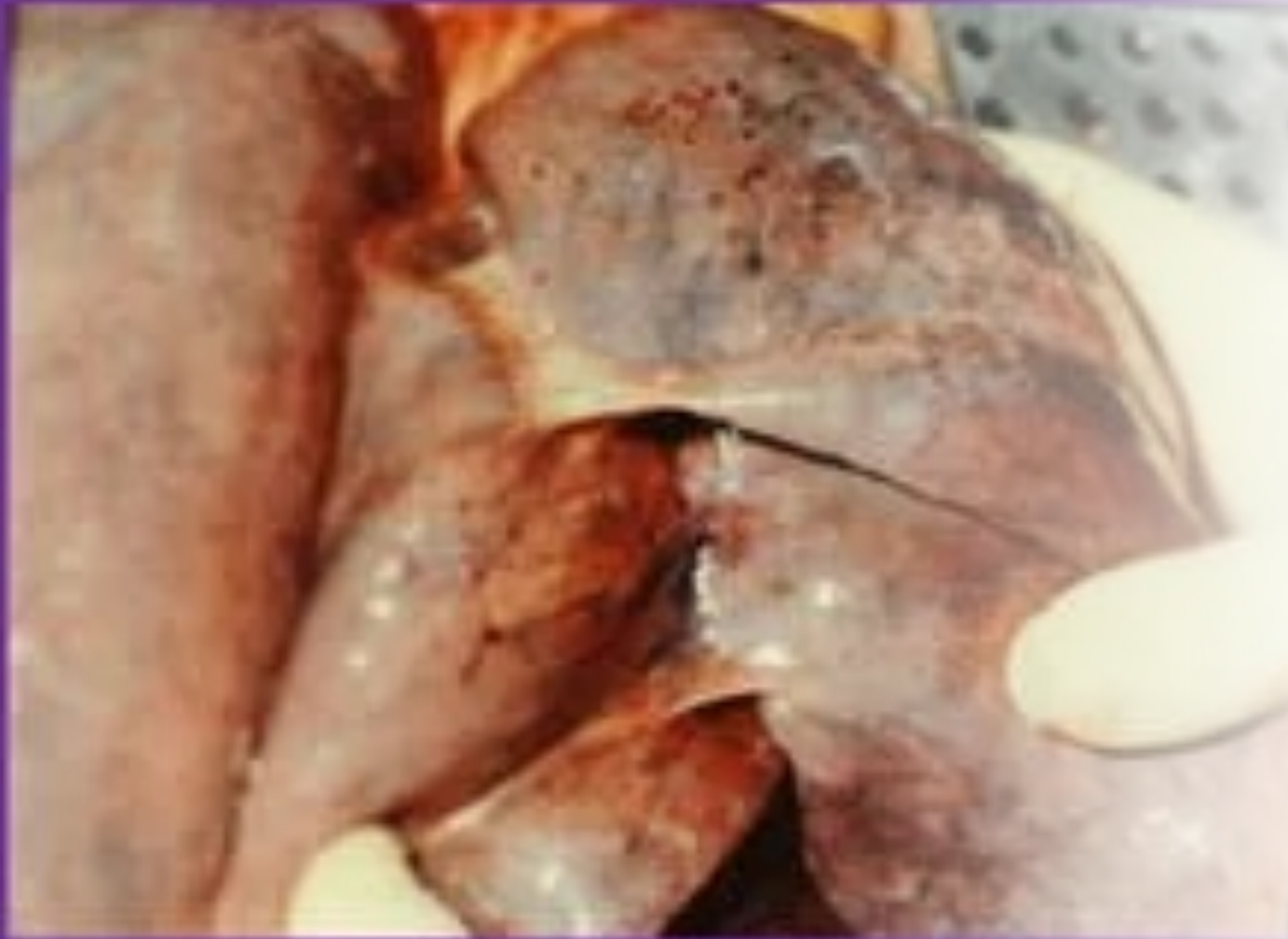
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B. Internal signs:

1. Congestion of the viscera and the mucosa of air passages, with bloody forth
2. Petechial hemorrhages “Tardieu’s spots”:
 - These are small pin-point collections of blood.
 - They are seen under the skin, the sclera or conjunctivae and under serous membranes such as the pleura, pericardium.
 - They are caused by an acute rise in venous pressure that in turn causes over distension and rupture of thin-walled peripheral venules, especially in lax tissues, such as the eyelid and in unsupported serous membranes, such as the pleura and pericardium.
 - They may disappear with increased PMI, in putrefaction and prolonged immersion.



Tardieu spots silver spots

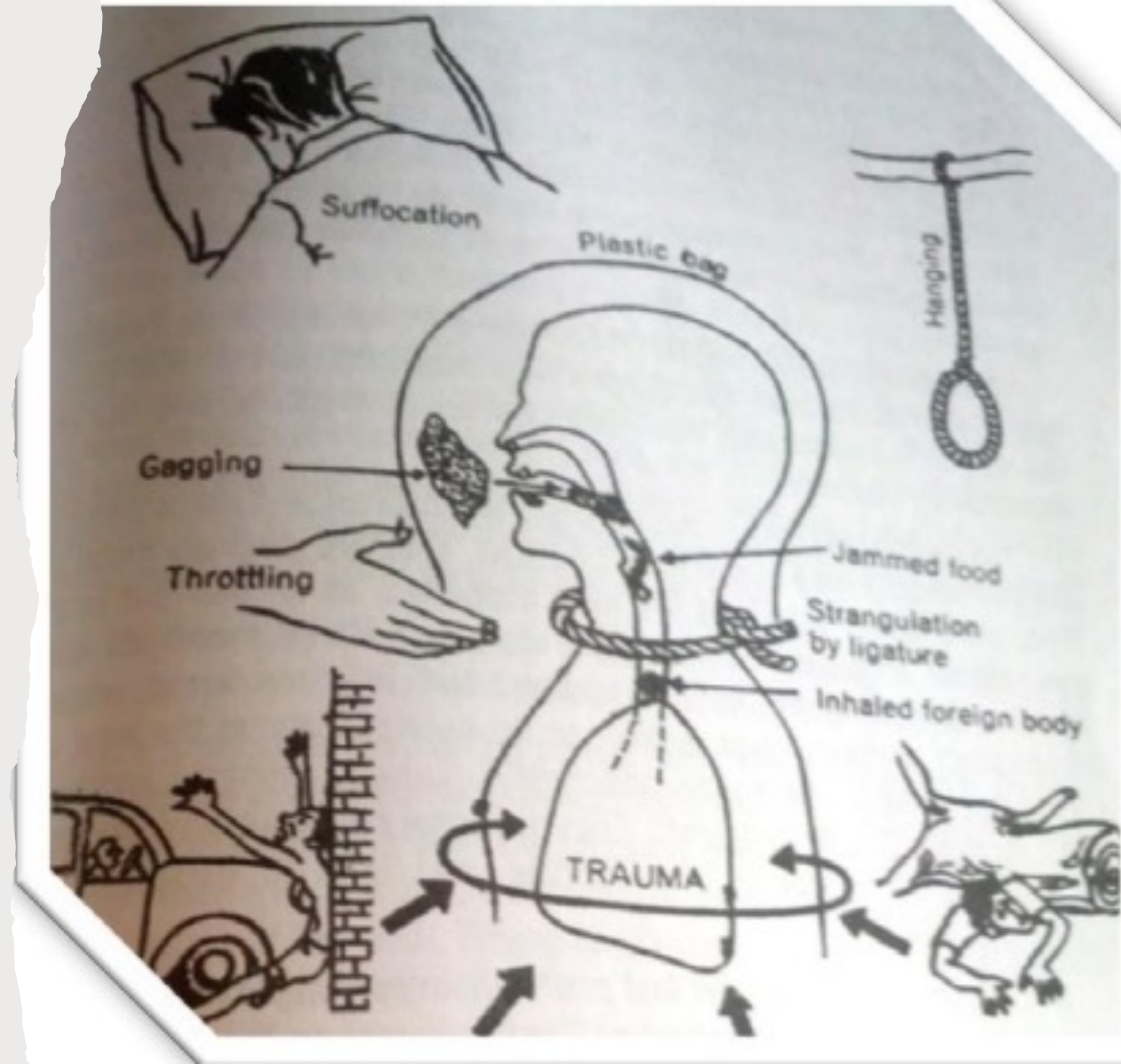


3. Silvery spots:

- These are shiny grey spots that appear sub-pleural and detected by hand lens examination. They occur due to increased intra-alveolar pressure during the convulsive phase with subsequent rupture of the superficial unsupported sub-pleural alveoli.

VIOLENT ASPHYXIA

- Types of Violent Asphyxia:
- 1. Smothering.
- 2. Suffocation.
- 3. Choking.
- 4. Throttling.
- 5. Strangulation.
- 6. Hanging.
- 7. Traumatic asphyxia.
- 8. Sexual asphyxia.
- 9. Drowning.





1. SMOTHERING

- A type of violent asphyxia due to manual obstruction of the **external respiratory orifices** (mouth and nostrils) usually by the hands or soft objects.



Conditions:

1. Homicidal:

- Most commonly applied to old feeble persons, infants or unconscious victims who cannot resist.



Cosleeping With Baby Is It Safe?

2. Accidental:

- Infants sleeping in prone position.
- Overlaying: a nursing mother accidentally laying her heavy lactating breast on her suckling baby's mouth and nostrils. The same may occur if an adult person sleeping beside an infant and rolling on it by his arm or his body.

Pressure marks from bedding or clothing may be seen on the victim, but these can happen postmortem.

These cases are likely to be victims of sudden infant death syndrome (SIDS)



- Accidental smothering is common in alcoholics or epileptics who may fall or roll over in a heap of mud or such other material.



Smothering post-mortem picture:

A. General:

- External and internal signs of asphyxia.
- Signs of struggle or resistance (in homicide).
- Ventral hypostasis in cot death.

B. Local:

- Pallor around the mouth and nostril.
- Semilunar nail abrasions and bruises detected at external respiratory orifices which coincide with the number and distribution of the nails (four on the left side and one on the right side if the assailant used the right hand and vice versa if the left hand was used). These findings may be absent if a soft pad or pillow was intervening between the hands and the face.
- Bruises and contused wounds in the inner aspect of the lips, cheeks and gums as they were pressed against teeth which may be broken.



Mechanism
of Death

- Mechanical anoxia.
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2. CHOKING

- Definition: A type of violent asphyxia due to blockage of the **internal respiratory passages**, at the pharyngeal, the laryngeal or the tracheal level.
- Accidental choking deaths are common in children < 1 year of age. Ninety percent of choking deaths happen before the age of 5 years.



Conditions:



1- Pathological: angioneurotic edema of the glottis

2- Accidental:

- Inhalation of irritant fumes.
- Inhalation of dust and sand as in falling houses with resulting edema of the glottis or occlusion of the respiratory orifices.
- Accidental swallowed vomits or extracted teeth as in dentistry or blood clot after tonsillectomy.
- Falling back of the tongue in comatose patients.
- Café coronary: Choking occurs suddenly while eating. The obstructing foreign body will wedge into laryngopharynx & stimulate **vagal nerve endings** resulting in reflex cardiac arrest.

3- Homicidal: Rare; often occurs in infanticide by packing the infant pharynx with a piece of cotton or tissue.

Chocking post-mortem picture:

- A. General: signs of asphyxia may occur.
- B. Local: The foreign body is detected in air passages.
- C. In an epileptics, tongue may show bite marks or bruising.



Chocking mechanism of death:

1. Asphyxia: where airway obstructed by foreign body which may be (partial) that is completed by laryngospasm or increased mucous secretion, with appearance of external and internal signs of asphyxia.
2. RSI: rapid silent death from vasovagal cardiac arrest (sensitivity of the pharynx or larynx to sudden stimulation).



3. Gagging

Fabric or adhesive tape is used to occlude the mouth and prevent speaking or shouting as sometimes happens in robbery with violence. In this case the nasal passages remain patent, air can enter, but later blockage by mucus and/or edema may lead to death.



4. SUFFOCATION

- Definition: It usually refers to a death caused by reduction of the oxygen concentration in the respired atmosphere.
- Plastic bag suffocation: It may occur accidentally in children or deliberately in adults as a suicidal act. It may also be homicidal.
- The plastic bag becomes electrically charged and adheres to the face, aided by condensation. It is a common method of suicide among the elderly and debilitated individuals.



A hand holding a sign that says "NOTHING". The sign is white with a grey border and the word "NOTHING" is written in large, bold, black capital letters. The hand is yellow and is holding a brown pole. The background is red.

NOTHING

Postmortem picture

- The “classic signs” of asphyxia are almost always absent.

1- It is very rare to find any petechial hemorrhages, as these are mainly due to venous obstruction, which is absent in suffocation.

2- Congestion and cyanosis are often absent and the autopsy findings are essentially negative.

Suffocation
mechanism of
death:

- Hypoxic
- Reflex Cardiac Inhibition



5. THROTTLING (MANUAL STRANGULATION)

- Definition: A type of violent asphyxia in which the neck is constricted forcibly by the hands (performed by one or both hands from front or back).
- Pressure must be applied for at least 2 minutes to cause death

Conditions:

1- Homicidal: It is a common mode of homicide of a man against a woman or less often a child by a man.

2- Suicidal: Impossible; because as soon as the person throttles himself, he loses consciousness with subsequent relaxation of his hands and released neck grip. A rare condition occurs when cadaveric spasm continues the obstruction.

3- Mugging (arm-lock)

Application of pressure to the neck by means of an arm crooked around from the rear.



Throttling post-mortem picture:

A. General: External and internal signs of asphyxia.

N.B. In cases of rapid death due to carotid body stimulation, there will be no facial congestion, petechiae or cyanosis indicating continuous pressure on the carotid sinus lasting not more than 5 seconds.

B. Local:

1- Semilunar nail abrasions and bruises on the front and sides of the neck. Their distribution and number help for detecting the identity of the assailant (right or left handed or missing a finger), his position with respect to the victim and whether he used one or both hands.

2- Linear abrasions; due to the movement of the victim's fingers along his neck to release the pressure.

3- Extravasation of blood in subcutaneous tissues underneath the external marks of bruising and abrasions is the most significant internal sign.

4- Inward compression fracture of hyoid bone is the **most diagnostic finding of throttling**

5- Damaged larynx and fracture or split of the thyroid cartilage.

6- fracture of the cricoid cartilage would only occur in throttling (vs hanging/ strangulation)



Mechanism of Death:

- 1- Mechanical anoxia is the chief cause of death.
- 2- Reflex cardiac inhibition (compression of carotid sinus).
- 3- Cerebral anemia (compression of carotid artery).
- 4- Delayed edema of the glottis.

5. STRANGULATION

Definition: A type of violent asphyxia in which neck is constricted forcibly by a rope or any ligature (wire, electric cable, etc....) thus preventing air entry through respiratory passages.



Conditions:

1- Homicidal: Most common.

2- Accidental:

- Children playing with ropes
- Strangulation of the fetus by the umbilical cord during labor.
- Victim's clothing such as a necktie or scarf "long-scarf syndrome" caught in moving machinery as a bicycle wheel

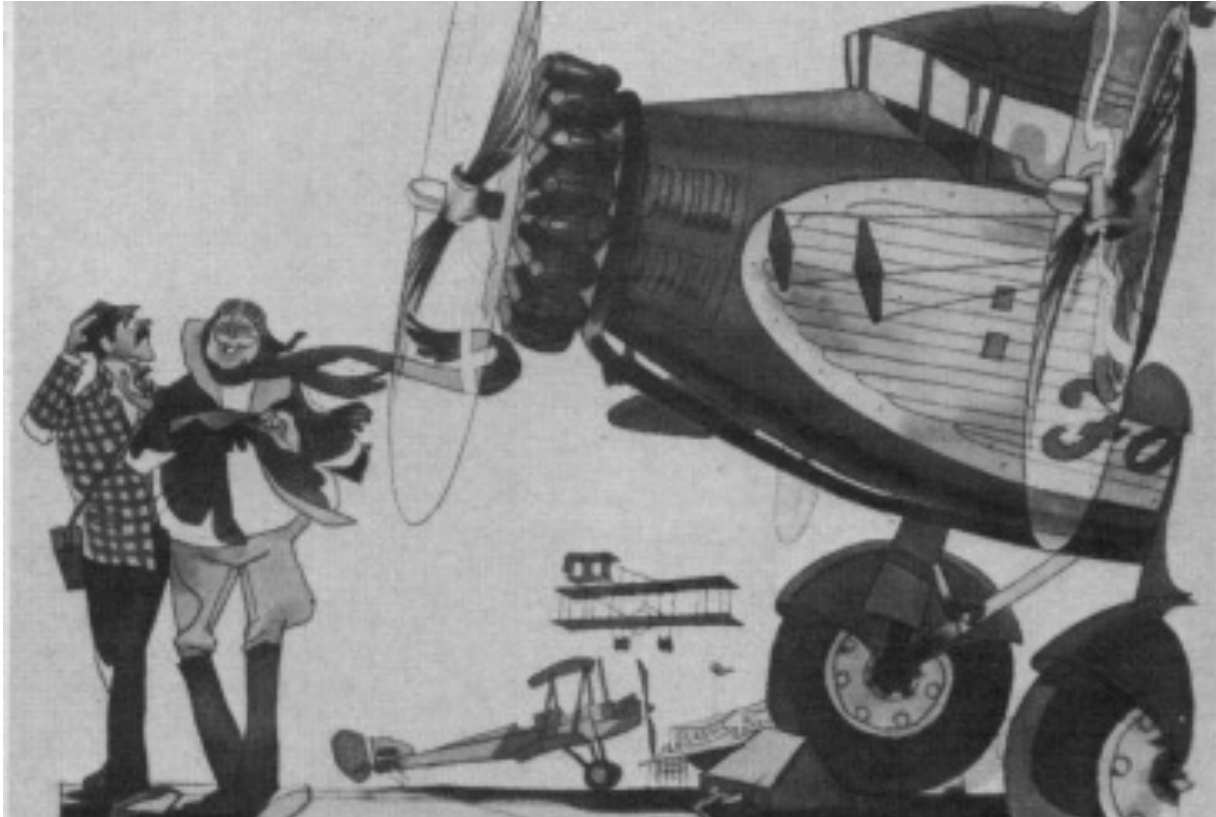


3- Suicidal:

Rare but may be achieved by using:

- Tourniquet mechanism (a solid object is applied to hold the rope then twisting it continuously)
- Adhesive ligatures
- Winding several firmly tightened turns of a rope around the neck before loss of consciousness.

Long-scarf syndrome



Incaprettamento



Strangulation post-mortem picture:

A. General: External and internal signs of asphyxia.

B. Local:

1- Ligature mark: Formed of abrasions and contusions and surrounded by congestion, petechiae and hyperemia.

- Takes the pattern and size of the ligature.
- Well defined and deep if a wire or thin cord is used, diffuse and faint in case a soft fabric is used, may be absent if the ligature is removed immediately after death.
- Transverse and located just below the laryngeal prominence.
- Complete circle involving the whole circumference of the neck.

2- There may be scratches and abrasions on either side of the neck as a sign of resistance (if the victim tried to pull the ligature).

3- Congestion and bruises of neck muscles.

4- Fractures of the thyroid cartilage and the hyoid bone with inward displacement but of less severity than manual strangulation.

Mechanism of Death:



- 1- Mechanical anoxia is the chief cause of death.
- 2- Reflex cardiac inhibition.
- 3- Delayed edema of the glottis.

6. HANGING

- Definition: It is a type of mechanical anoxia due to suspension of the body from the neck by a ligature. The constricting force is produced by the weight of the body.



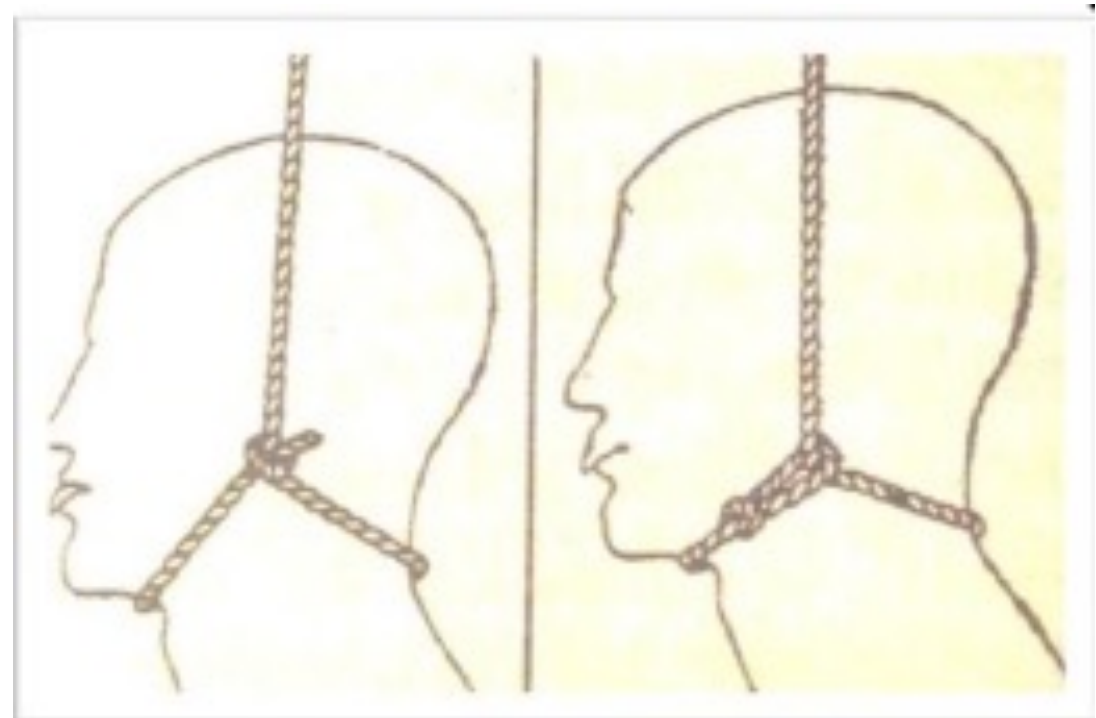
Conditions:

1-Suicidal: Self suspension hanging is the commonest form in which a slip knot or running noose (the end of the ligature passes through a loop) is done by the suicide and the free end of the rope is fixed at a higher point.

2-Accidental: Not common and occurs in:

- Children playing with ropes or entrapped by head between double bars (beds, windows, stairs).
- Falling men from scaffolding entangled in ropes.

3-Homicidal: Very rare except in narcotized or unconscious victims and post-mortem suspension to simulate suicide.



Types of Hanging:

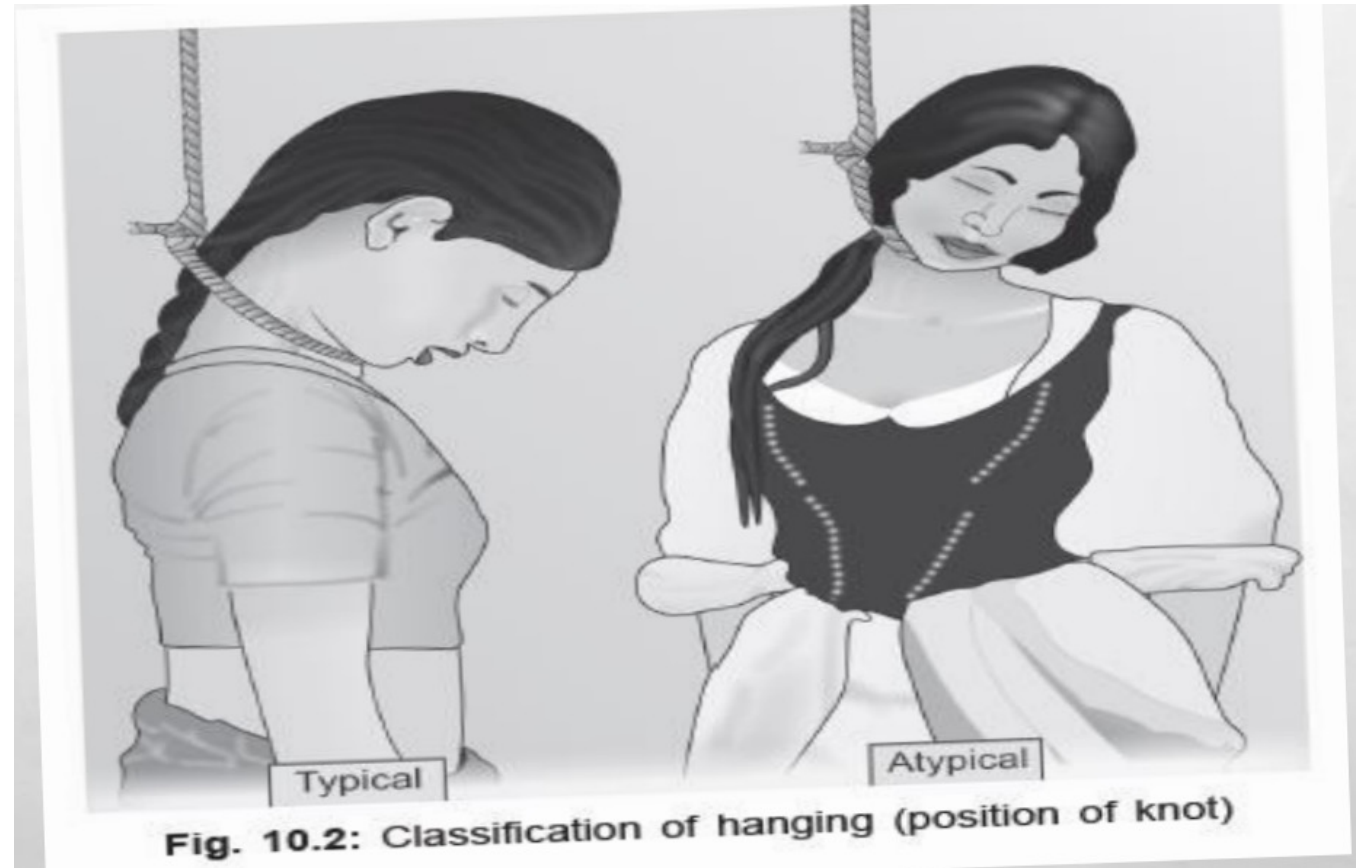
Based on degree of suspension:

- Complete: if the body is freely suspended without touching the ground at any point.
- Incomplete: if any part of the body touches the ground (e.g. Toes, knees, shoulders,...). ; Almost always **homicidal** in nature.



Fig. 10.3: Classification of hanging (degree of suspension)

- Based on position of the knot:
- Typical hanging: When the point of suspension is placed centrally over the occiput, i.e. the knot is at the nape of neck on the back.
- Atypical hanging: Knot of ligature is anywhere other than on the occiput.



Hanging post-mortem picture:

- General:

- 1- External and internal signs of asphyxia.
- 2- Hypostasis in the lower parts of the body (lower limbs, hands, lower abdomen & genitalia).
- 3- Engorged genital organs with ejaculation in males.

- Local:

- 1- Ligature mark “furrow”

- Well-defined groove, which is slightly depressed. The base of the furrow is usually red and accompanied with congestion or ecchymosed margins. Base may show imprint pattern of the ligature material used.
- Incomplete circle around the neck as it is absent at point of suspension (in fixed Knots) where the rope rising upward away from the skin to a peak point at the junction between the knot and the vertical part of the rope
- Asymmetrical: deepest opposite the point of suspension and fades gradually upwards to be absent at the site of the knot
- Oblique and located high up in the neck.

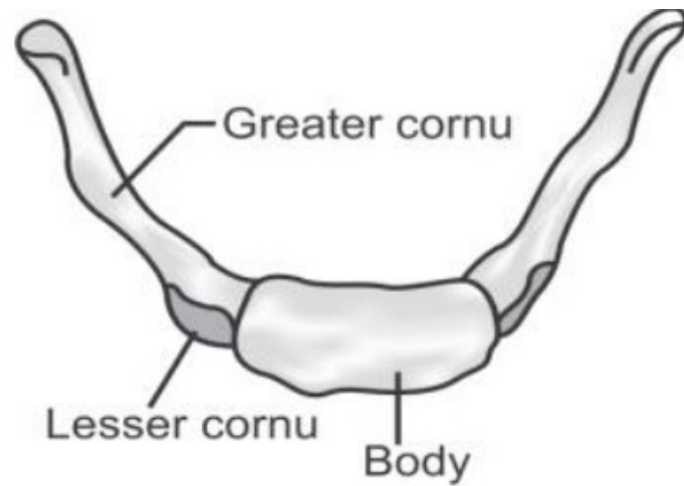
- 2- **Dribbling of saliva** due to pressure on the submandibular gland.

- 3- Neck muscles show bruises and lacerations.

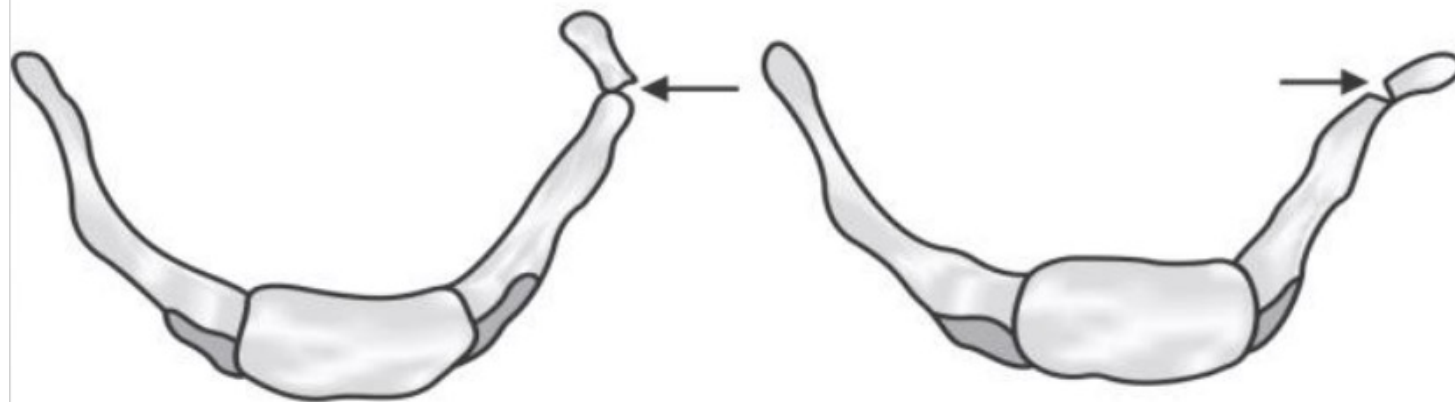
- 4- Carotid arteries show transverse intimal rupture (due to their elongation).

- 5- **Outward** Fracture of the hyoid bone or posterior horn of the thyroid cartilage due to stretch of the stylohyoid and thyrohyoid ligament.





Parts of hyoid bone



Throttling
(Inward compression)

Hanging
(Outward compression)

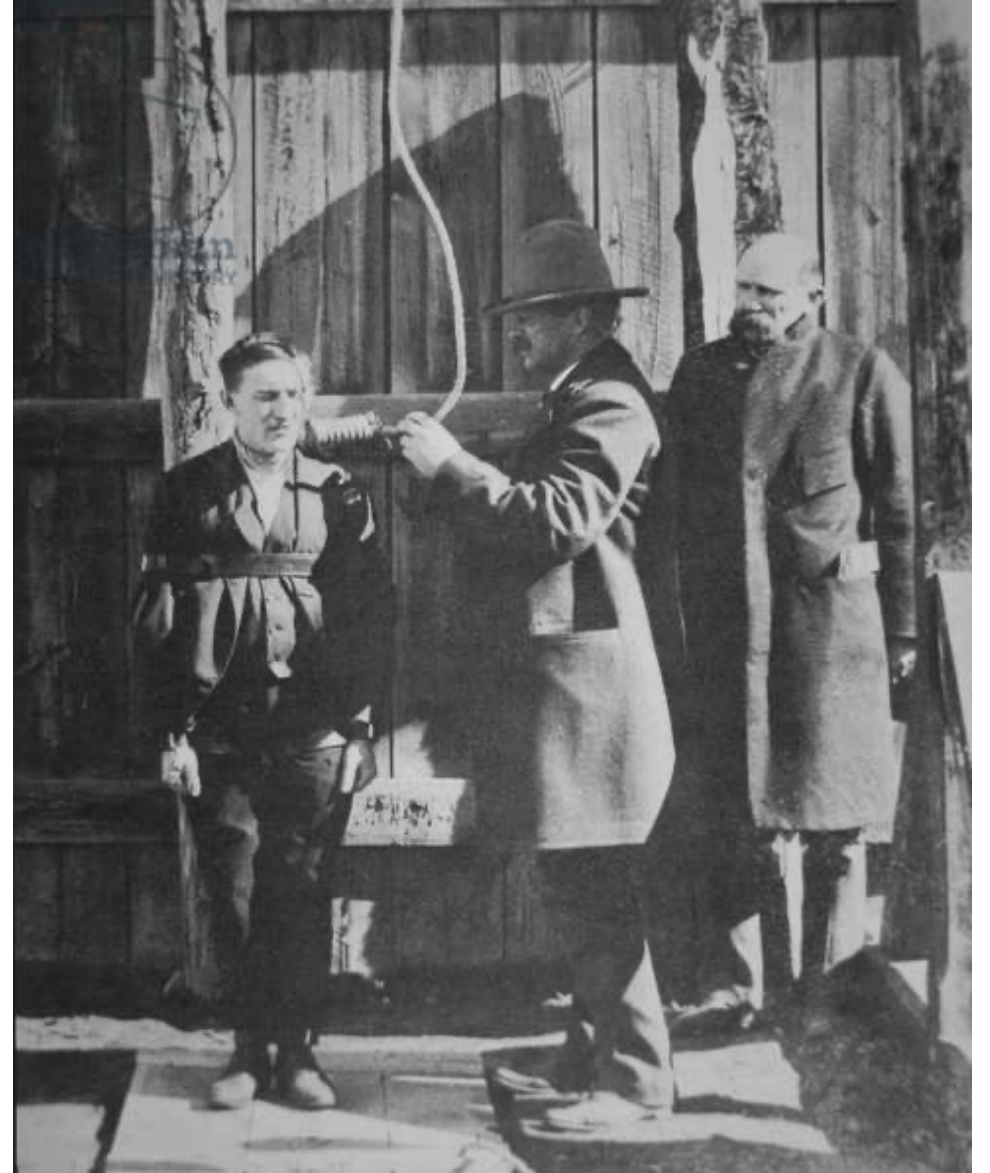
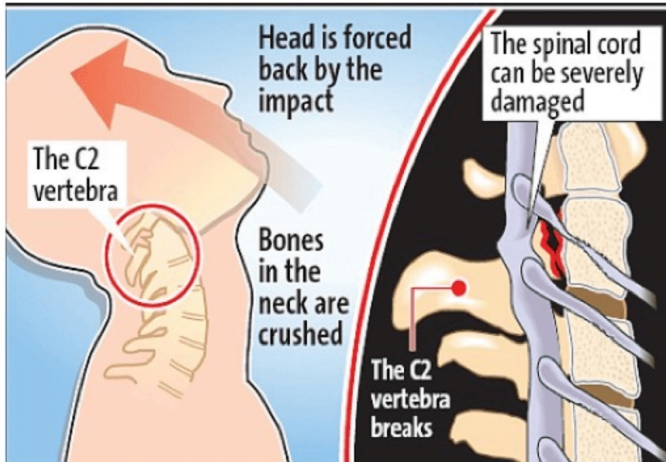
Ligature mark	Strangulation	Hanging
1- Site	Low below larynx	High above larynx
2- Shape	Complete circle	Incomplete circle (except running noose/ double turns).
3- Direction	Transverse	Oblique
4-Compression	Symmetrical	Asymmetrical

Differentiation 10.1: Antemortem and postmortem hanging

S.No.	Feature	Antemortem hanging	Postmortem hanging
1.	Salivary dribbling mark	Present	Absent
2.	Fecal/urinary stains	May be present	Absent
3.	Ligature mark <ul style="list-style-type: none"> ◆ Direction ◆ Continuity ◆ Level in the neck ◆ Parchmentization ◆ Vital reaction 	<ul style="list-style-type: none"> Oblique Non-continuous Above thyroid Present Present 	<ul style="list-style-type: none"> Circular Continuous At or below thyroid Absent Absent
4.	Knot	Single, simple, on one side of neck	Multiple, granny or reef type on occiput/chin
5.	PM staining <ul style="list-style-type: none"> ◆ Above ligature mark ◆ In lower limbs ◆ Glove-stocking like 	<ul style="list-style-type: none"> Present Present Present 	<ul style="list-style-type: none"> Absent Absent Absent
6.	Evidence of injury <ul style="list-style-type: none"> ◆ Self-inflicted ◆ Struggle ◆ Tear of carotid artery intima ◆ Imprint abrasion 	<ul style="list-style-type: none"> Present Absent Present Present 	<ul style="list-style-type: none"> Absent Present Absent May/may not be present
7.	Elongation of neck	Present	Absent
8.	Cyanosis	Deeply positive	Absent or faintly present
9.	Emphysematous bullae on lungs	Absent	Present
10.	Point of suspension	Compatible with self-suspension	Not so
11.	Histochemistry of ligature mark	Increased serotonin and histamine	Not so

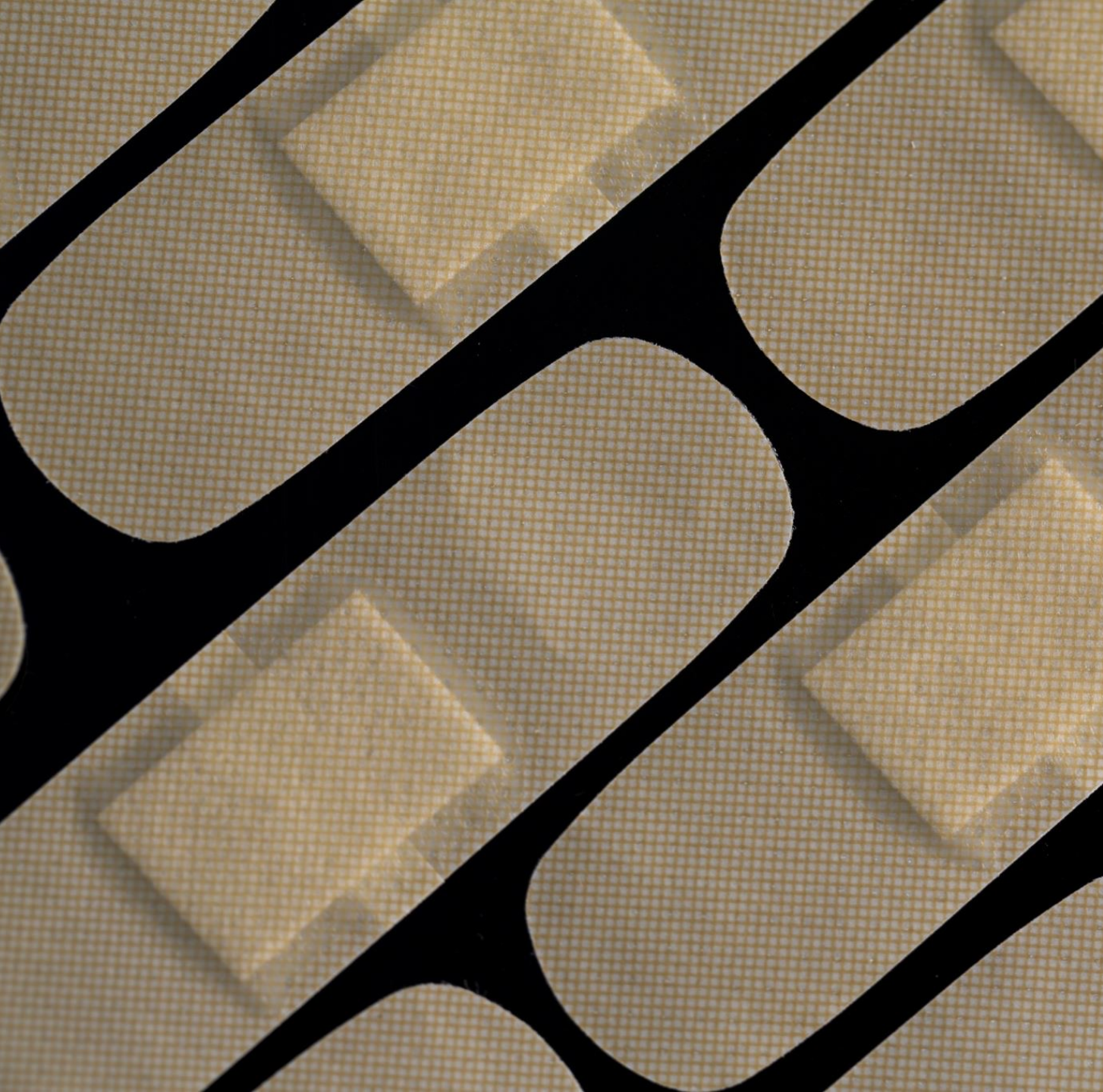
Mechanism of death:

- 1- Cerebral anemia: The commonest cause, due to stretch of the carotids and their elongation with subsequent narrowing. This mechanism explains the rapid loss of consciousness (victim cannot save himself).
- 2- Reflex cardiac inhibition: due to pressure on the carotid sinus.
- 3- Mechanical asphyxia: due to backward displacement of the base of the tongue.



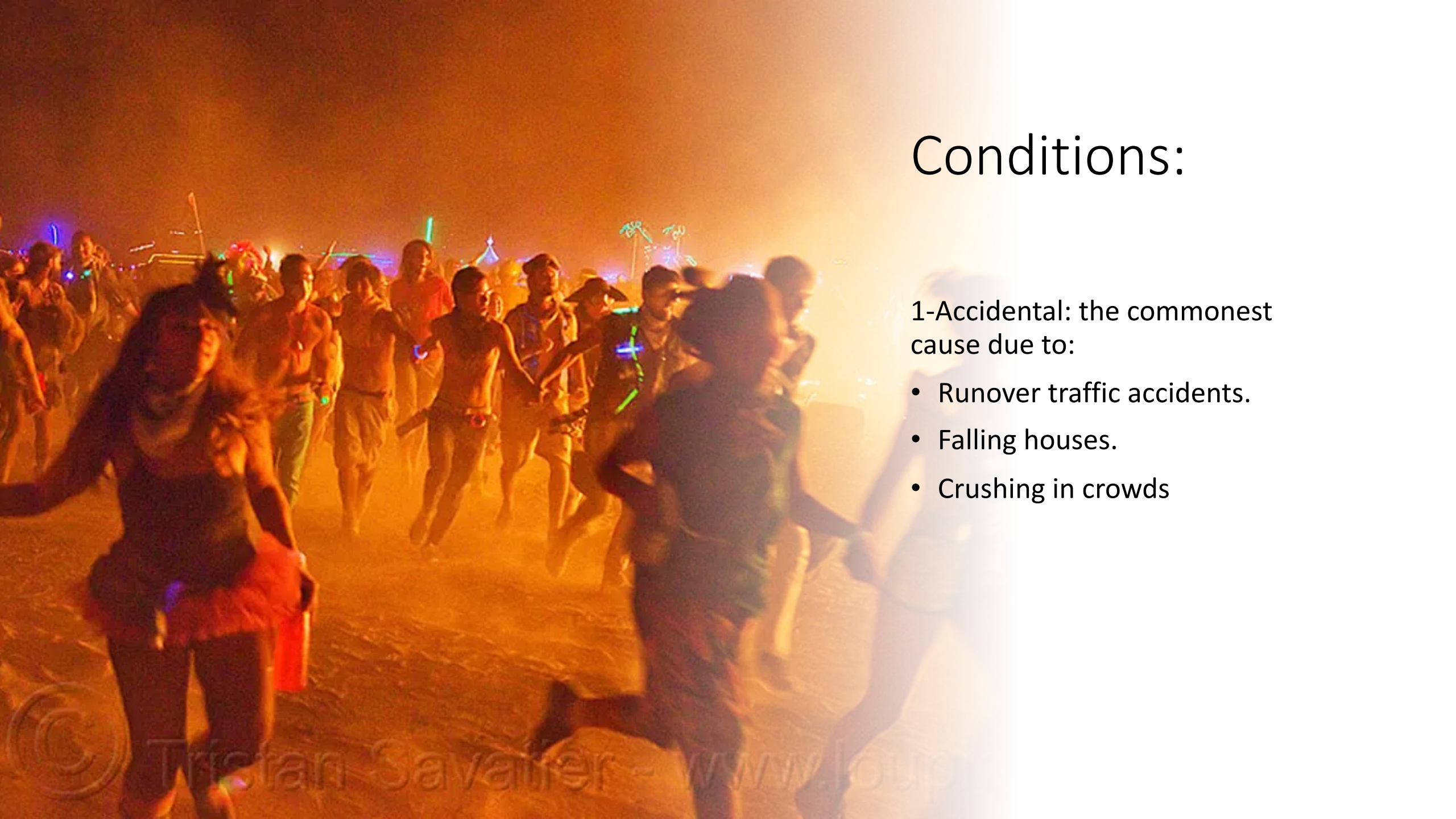
- 4- Tearing of the medulla: following Fracture dislocation of the cervical vertebrae. Common with “Judicial hanging” due to the long drop of more than two meters.

Fracture dislocation is most common between C2-C3.



7. TRAUMATIC (CRUSH) ASPHYXIA

- Definition: A type of mechanical asphyxia due to fixation of the chest and abdomen by external mechanical compression preventing respiratory movements.



Conditions:

1-Accidental: the commonest cause due to:

- Runover traffic accidents.
- Falling houses.
- Crushing in crowds



"Hark! the Doctor knocks - she is almost done - and ready for you - the old Play



2-Homicidal:

Historical method of killing called "Burking".

o Mechanism of death:

1- Mechanical asphyxia.

2- Injury of vital organs.

BURKING POOR OLD M^{RS} CONSTITUTION. Aged 141. Feb April 1829 by J.M. Lewis

Traumatic post-mortem picture:

- It provides the most remarkable demonstration of the 'classic signs' of asphyxia:

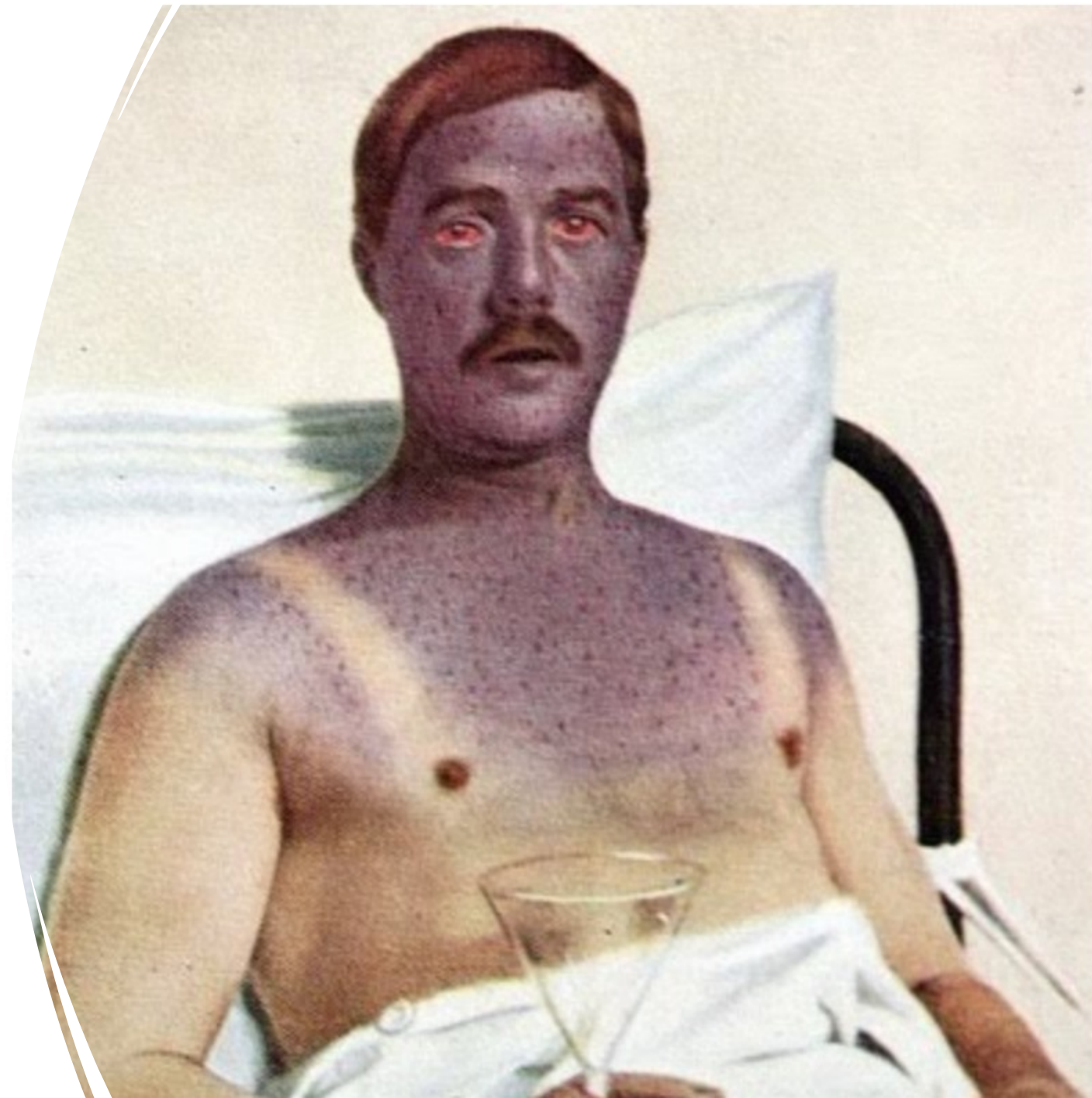
1- The most classic feature is the blue congestion of the face, neck and upper part of the chest. Together with pallor at the site of compression. There is a distinct line of demarcation between the congested and the pale parts.

2- The conjunctivae are grossly congested and hemorrhagic.

3- There may be local bruises and abrasions from the compressing weight.

4- Internally, the congestion is less marked than externally, but the lungs are usually dark and heavy and may as well show subpleural petechial hemorrhages, the true "Tardieu spots".

5- Other injuries: contusions and abrasions of chest wall, fracture ribs or sternum and rupture of heart or lungs



8. SEXUAL ASPHYXIA

- Death in sexual asphyxia is accidental self- induced; that happens suddenly during attempts of inducing hypoxia in order to reduce the blood supply to the brain; which appear to produce auto erotic hallucinations in some persons during the course of solitary sexual activity.
- The condition is more common in males of any age. It usually occurs in isolated closed places. There may be evidence of transvestism, exhibitionism, mirrors, cameras, pornographic materials.
- Many forms of violent asphyxias are applied as; smothering, strangulation, hanging or suffocation.



THANK
YOU

HEIL BOY OF HAPPINESS