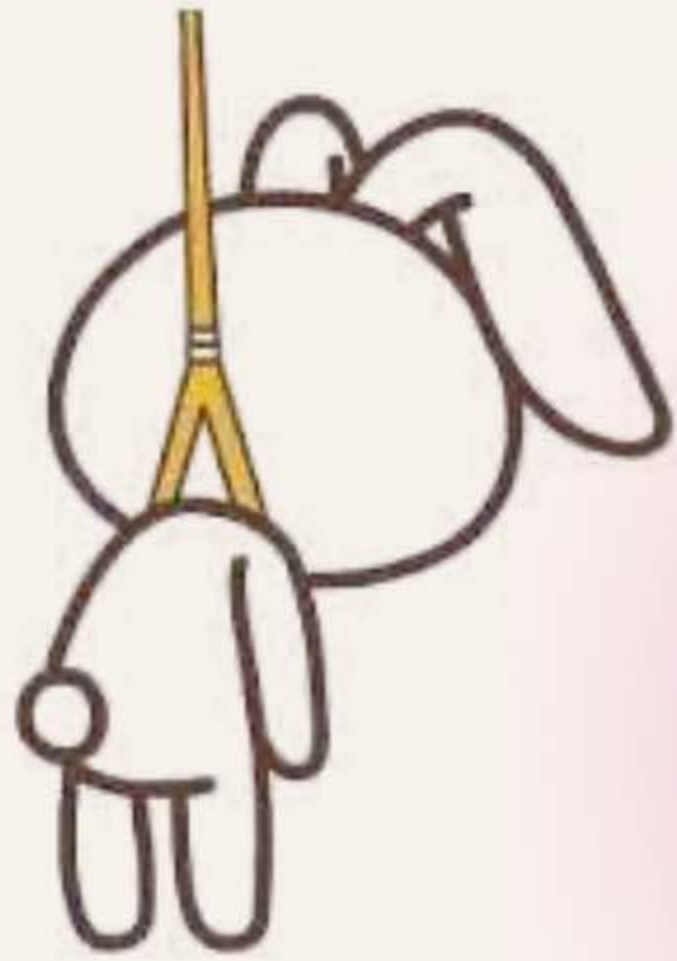




Mechanical



asphyxia

Done by: razan alfrayeh
sara jamal
sara shorman



Definition of Asphyxia

Asphyxia (Greek, 'pulselessness' or 'absence of pulse') is a condition caused by interference with the exchange of oxygen and carbon dioxide in the body

it is commonly used to describe a range of conditions of lack of oxygenation either partial(hypoxia)or absolute(anoxia)



Etiology of Asphyxia

1. Mechanical/violent: Mechanical interference to the passage of air into the respiratory tract

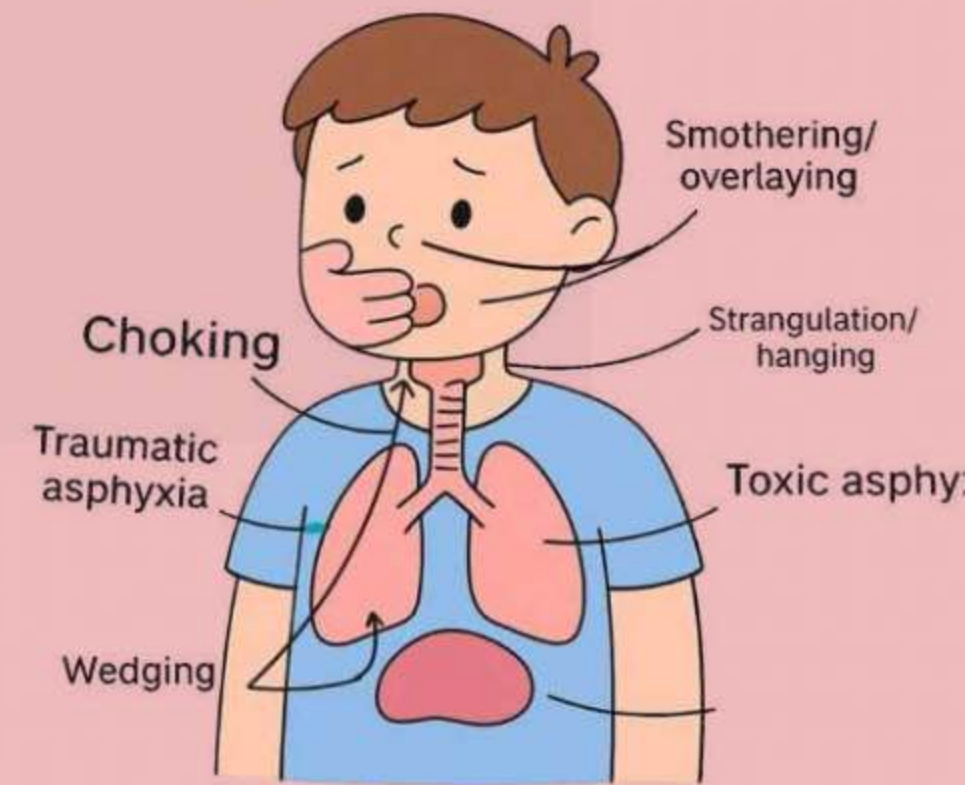
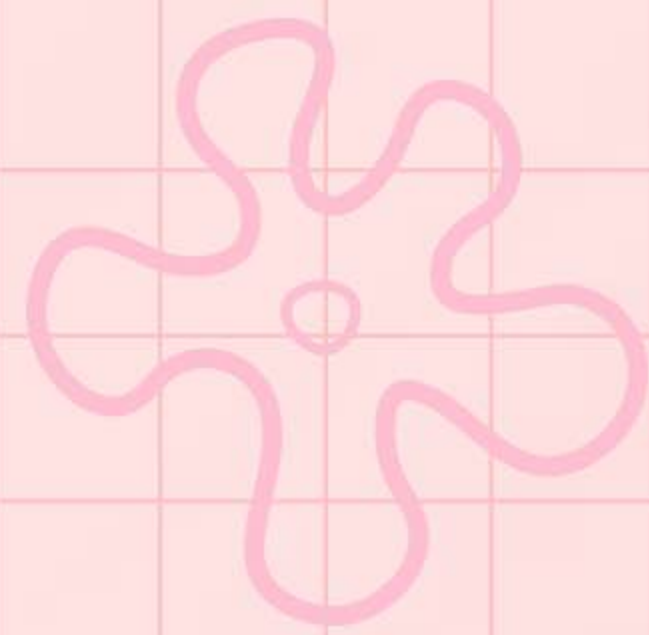
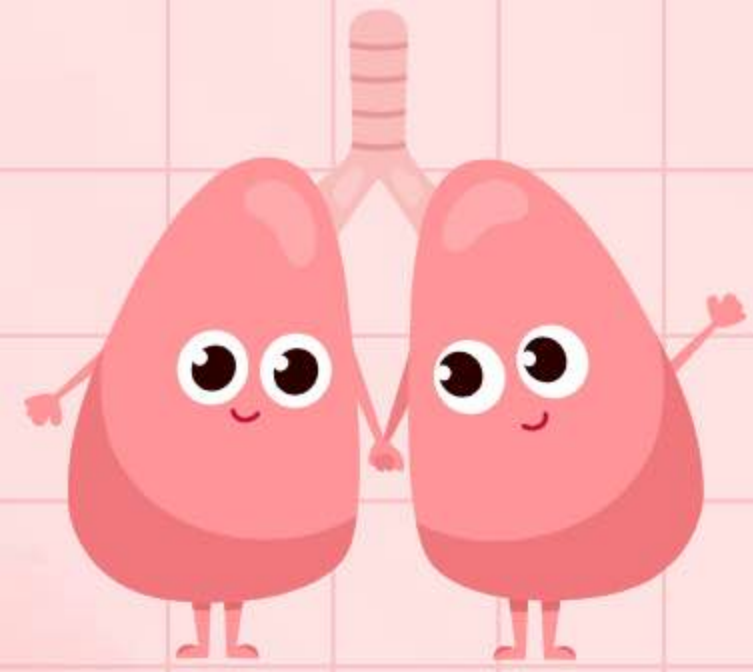


Table 10.1: Asphyxial conditions

<i>Classification</i>	<i>Level of obstruction</i>	<i>Cause</i>
Strangulation/hanging	Neck (including larynx, trachea and major blood vessels)	Occlusion of the internal airways by external pressure
Smothering	Mouth and nose	Blockage of the external orifices
Gagging	Nasopharynx	Blockage of the internal airways
Choking	Larynx	Blockage of the internal airways
Overlaying	Mouth, nose, chest	Occlusion of mouth and nose, and blockage of the internal airways by external pressure
Traumatic asphyxia	Chest	Restriction of chest movement due to external mechanical fixation
Wedging	Neck and chest	Occlusion of the internal airways by external pressure
Drowning	Upper and lower respiratory tract	Occlusion of the internal airways by fluid
Toxic asphyxia	Lung	Failure of oxygen transportation/utilization; CO or cyanide poisoning



Etiology of Asphyxia

2. Pathological: Entry of oxygen to the lungs is prevented by disease of the upper respiratory tract or lungs, e.g. laryngeal edema, spasm, tumors or abscess

3. Toxic or chemical Cessation of the respiratory movements due to paralysis of the respiratory center in poisoning with morphine, barbiturates or strychnine

6. Traumatic: Blunt trauma to the thorax may result in pneumothorax, hemothorax or pulmonary embolism that will interfere with oxygenation and ventilation by compressing

4. Positional/postural: Positional asphyxia is due to abnormal body position that prevents adequate gas exchange.

5. Environmental: Breathing in vitiated atmosphere, as in high altitude, climbing or flying, or inhalation of carbon monoxide (CO), sewer gas or pure helium.



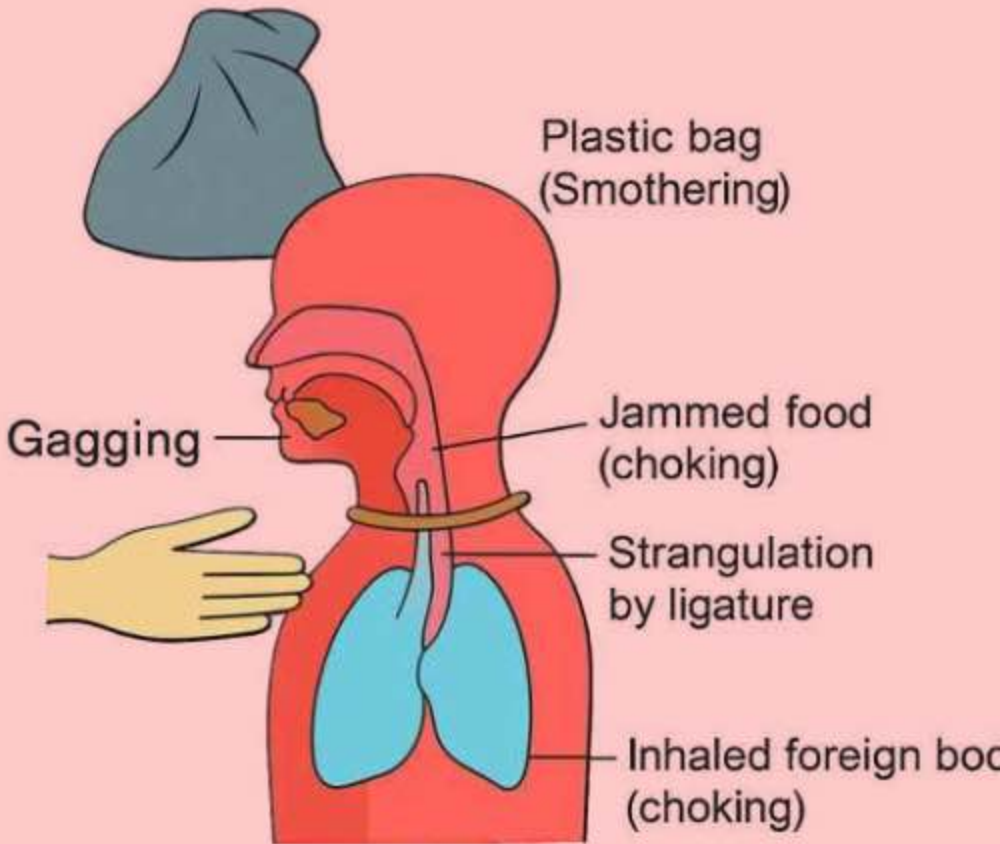
Smothering



Hanging



Traumatic asphyxia



Stages of Asphyxia

01

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.

02

Stage of convulsions:
Cerebral irritation due to anoxia and hypercarbia. Clinical picture:

cyanosis , constricted pupils , convulsions, hypertension ,

03

Stage of paralysis:
irreversible brain damage

Clinical picture:

Dilated fixed pupils , Death occurs in about 5 minutes , Muscle relaxation (evacuation of bladder and vomiting) ,

Drop of blood pressure , Deepening of cyanosis , Loss of consciousness , Irregular breathing (Chyne-stocks) breathing



1

External signs

- Petechial hemorrhages in the face (eye, lips & behind ears)
- Congestion of the face
- Edema of the face
- Foam
- Cyanosis.
- Deep blue hypostasis • prominent eye
- protruding tongue

2

Internal signs

- Petechial hemorrhages
- Visceral congestion
- Postmortem fluidity of blood • Silvery spot

Classical signs of asphyxia



Cyanosis

due to increase in the amount of reduced hemoglobin.

Healthy

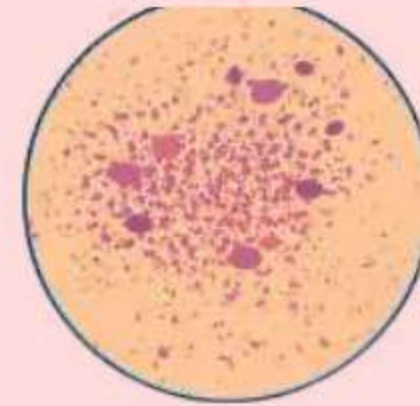


Cyanosed



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.



Petechiae
small, red or pur



Visceral congestion

due to obstructed venous return
and capillovenous congestion.



Silvery spot

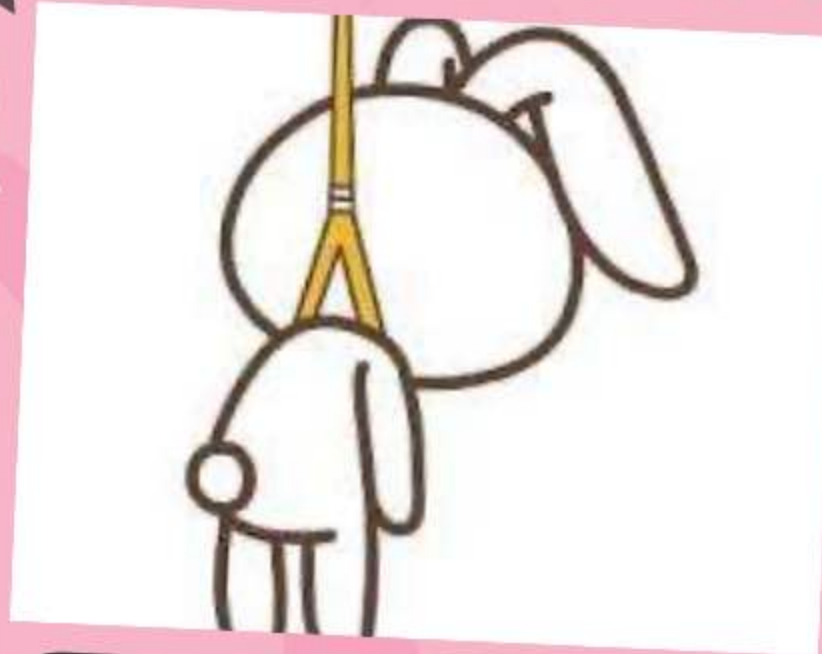
- which is a shining grey spots under the pleura (can be seen by a hand lens),
- due to increased intra- alveolar pressure with rupture of the superficial unsupported alveoli and coming out of their contents, i.e. air, dust, carbon.



mechanical asphyxia can be grouped into three categories



Suffocation



Pressure on the neck
(strangulation
,hanging)



Drowning

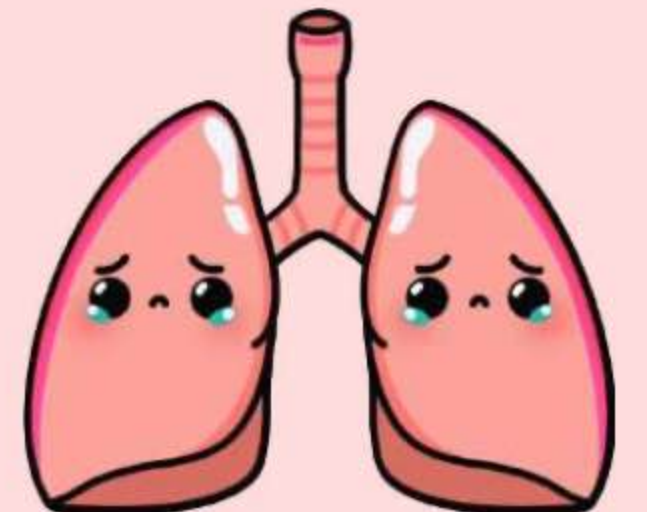


Suffocation

It is a form of asphyxia caused by mechanical obstruction to the passage of air into the respiratory tract by means other than constriction of neck or drowning

Classification:

- Smothering
- Gagging
- Traumatic asphyxia
- Choking
- Overlying
- Burking



Smothering

It is a form of asphyxia caused by mechanical occlusion of external air passages, i.e. the nose and mouth by hand, cloth, plastic bag or other material.

Postmortem findings

In the cases of homicides with pillows, there are usually no marks on the face, but there may be some bruising in the lips

In the case of homicides with hands, if the hands are used to smother an individual who is conscious and can resist, there may be fingernail abrasions on the nose and mouth, and bruising of the lips.



In the cases of suicide with plastic bags, there are no specific findings at autopsy. So, if the plastic bag is removed by a relative prior to notification of the police and/or the medical examiner, the diagnosis cannot be made.

Medico legal aspect

1. Homicidal smothering:

- Can occur in cases of sexual assault, robberies, burglaries, or kidnappings where the victim is gagged to keep them quite.*
- The nose and mouth may be obstructed by the hand, plastic bags, a soft object as pillow or bed clothing, or by pushing the face into the beddings.*
- The victims are usually very young or very old; debilitated or incapacitated by restraints, disease or drugs. It is difficult to smother adults in full control of their faculties.*



. Suicidal smothering:

- Can occur by using a plastic bag secured about the head.
 - It is more common among the elderly

3. Accidental smothering:

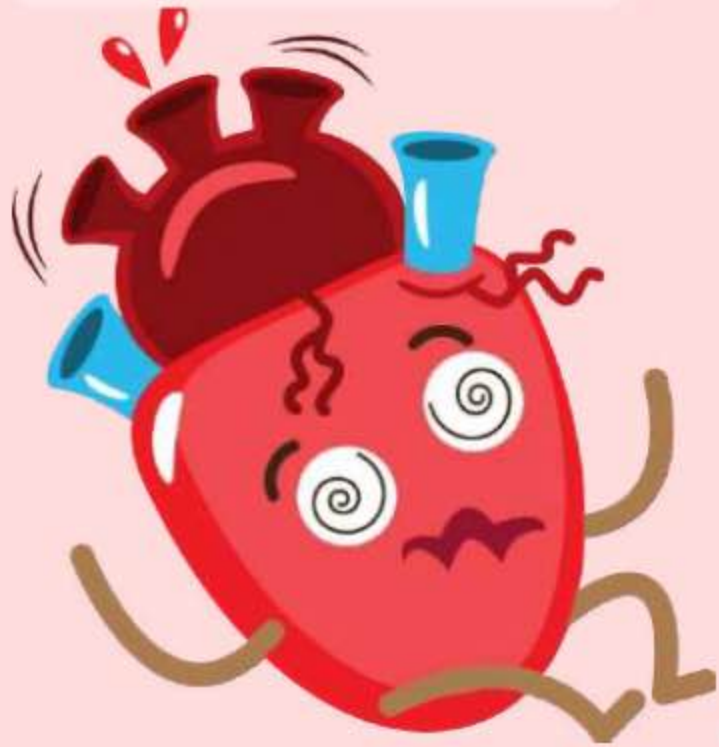
- Can occur in epileptics or persons comatose from drink or drugs who fall face down obstructing the nose and mouth, or in an infant who pushed the face into the mattress.



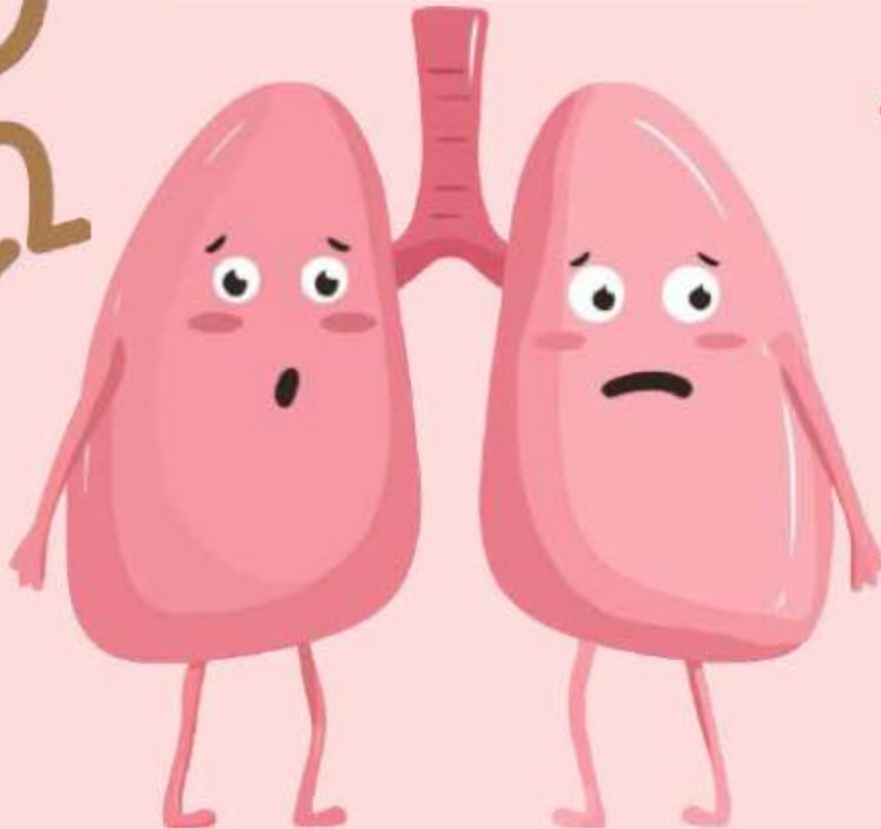
MECHANISM OF DEATH

The sequence of physiological events in smothering is:

Decrease in heart rate.



• Decrease in respiration to agonal gasps with eventual cessation of respiration.



• Slowing and finally flattening of electroencephalogram (EEG).



• The heart will continue to beat even after flattening of the EEG, but respiration will not return spontaneously if the smothering is stopped. The individual must be resuscitated.



Choking

It is a form of asphyxia caused by an obstruction within the air- passages at the pharyngeal, the laryngeal or the tracheal level. by a foreign object, like coin, fruit seed, toffees, candies, fish or any other material.

In an epileptic attack, tongue may fall back on to posterior pharyngeal wall causing choking.

POSTMORTEM FINDINGS

- i. Signs of asphyxial death.
- ii. Presence of food items or foreign body in respiratory tract. The food items are usually round and firm, yet pliable to allow molding in the airway.
- iii. In an epileptic, tongue may show bite marks or bruising.

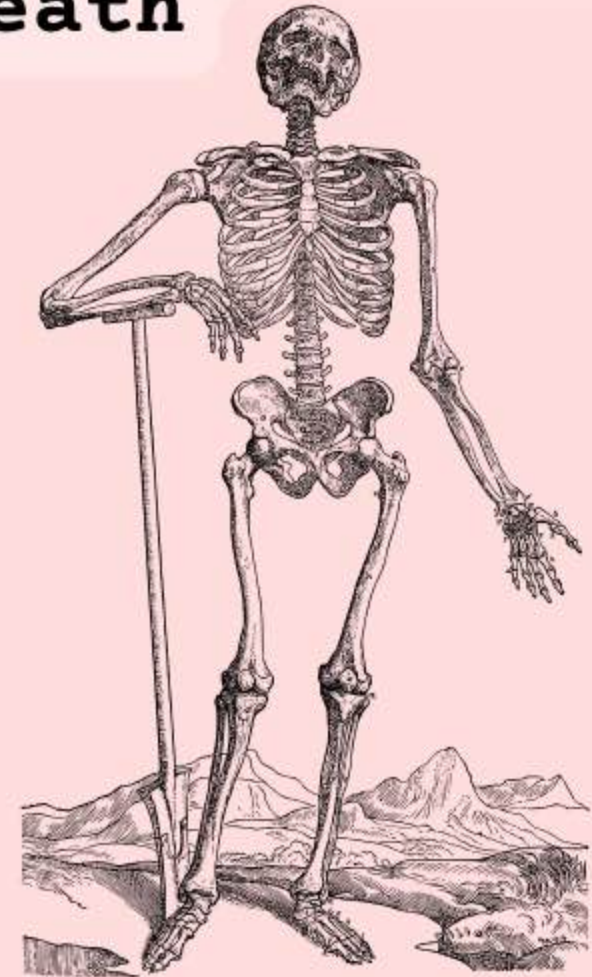
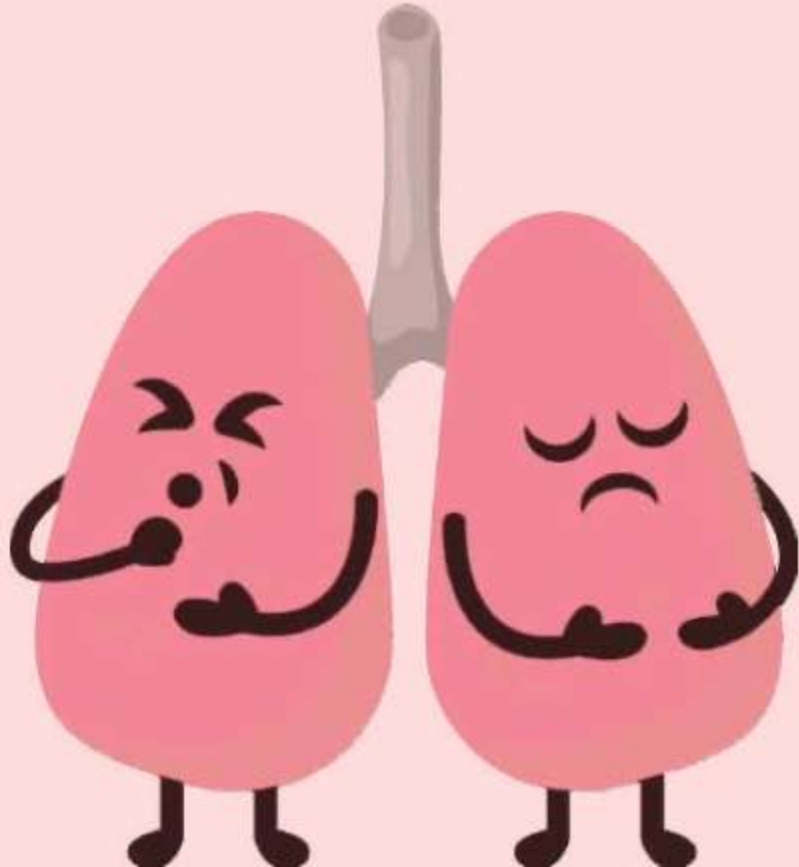


MECHANISM OF DEATH

Initially, there is stridor, respiratory distress, coughing and the inability of the victim to speak

This is followed by a rapid, deep inhalation, which causes the foreign object to pass further down the airway

Laryngospasm occurs, followed by vagal stimulation, leading to arrhythmia, apnea and death



Medico legal aspect:

Natural/ pathological choking :is seen in individuals with acute fulminating epiglottitis ,where there is obstruction of the airway by the inflamed epiglottis and adjacent soft tissue.

Homicidal choking: is rare and may occur in Infants, by backing toilet paper or cotton into their mouth and pharynx.

o Adults, this may be due to gagging, where a cloth or soft object is pushed into the mouth, often during a robbery or burglary to silence the individual. The cloth can work its way backward and obstruct the posterior pharynx, causing the individual to choke

Accidental choking:

- Blockage of the posterior pharynx and larynx by food or foreign objects.

In children, the typical object is a small toy or ball, extracted teeth, blood and clot after tonsillectomy and food material.

o In adults, choking always involves food and dentures.

o Aspiration of vomit (gastric content) may also block the air passages; it is usually associated with acute alcoholism, anesthetics, senility and neurological injury.

Suicidal choking

is uncommon, and may occur in psychiatric patients and prisoners.

CAFE CORNARY

This is the accidental entry of bolus of food or food particle into the air passage obstructing the larynx and death is due to reflex vagal inhibition. This may happen when the person is eating food in a restaurant and people may think death is due to cardiac arrest, hence the name.

- Causes -Cafe coronary .
1. Adult under the influence of alcohol due suppression of gag reflex
 2. Mentally ill persons who are under antipsychotic drugs.
 3. Elderly patients suffering from neuro-degenerative diseases
 4. Children under 5 years

Postmortem findings

1. Object causing choking is present in the airway
2. Tissue reaction on the bolus
3. Local inflammatory reaction in the tissues



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.



Overlaying ..

Overlaying or compression suffocation results from compression of the chest, nose and mouth, so as to prevent breathing.

It is a form of accidental smothering of an infant by a nursing mother, sharing a bed with her child who may roll over during sleep and occlude the air passages



MEDICO LEGAL ASPECT

PURELY ACCIDENTAL IN NATURE.

**THESE CASES ARE LIKELY TO BE VICTIMS OF SUDDEN
INFANT DEATH SYNDROME (SIDS)**

POSTMORTEM FINDINGS

**FACE, NOSE AND CHEST OF VICTIMCHILD MAY APPEAR
COMPRESSED AND PALE
PRESSURE MARKS FROM BEDDING OR CLOTHING MAY
BE SEEN ON THE VICTIM, BUT THESE CAN HAPPEN
POSTMORTEM.**

USUAL FINDINGS OF ASPHYXIA WILL BE SEEN



TRAUMATIC OR CRUSH ASPHYXIA

ASPHYXIA RESULTING FROM RESPIRATORY ARREST DUE TO MECHANICAL FIXATION OF CHEST, SO THAT THE NORMAL MOVEMENTS OF CHEST WALL ARE PREVENTED.

MEDICO LEGAL ASPECT

ACCIDENTAL :MOST MECHANICAL ASPHYXIA IS ACCIDENTAL

A.TRAUMATIC ASPHYXIA, IT OCCURS WHEN A HEAVY WEIGHT PRESSES DOWN ON AN INDIVIDUAL'S CHEST OR UPPER ABDOMEN, PREVENTING RESPIRATION

B.RIOT-CRUSH OR HUMAN PILE DEATHS, OCCURS IN RIOTS WHEN THE CHEST IS COMPRESSED BY STAMPEDING PEOPLE PILING ON TOP OF EACH OTHER



1

External signs

1. Masque ecchymotique
2. External blunt trauma injuries can be seen on the head, neck and chest
3. Facial edema



Postmortem findings

2

INTERNAL SIGNS

- Eyes** :Purtscher's retinopathy(retinal hemorrhages)
Bones: Rib and clavicle fractures
Face: Nose, ear or pharyngeal petechiae
Upper respiratory tract: Edema, epiglottic and laryngeal petechiae.
Lungs: Congested, heavy, subpleural petechiae; contusions/lacerations and hemo- /pneumothorax may be present.
Heart: Right heart and veins above aorta may be distended, injuries are rare.
Abdomen: Hepatic and splenic lacerations may be found.
CNS: Edema and petechiae can be seen.



Masque ecchymotique

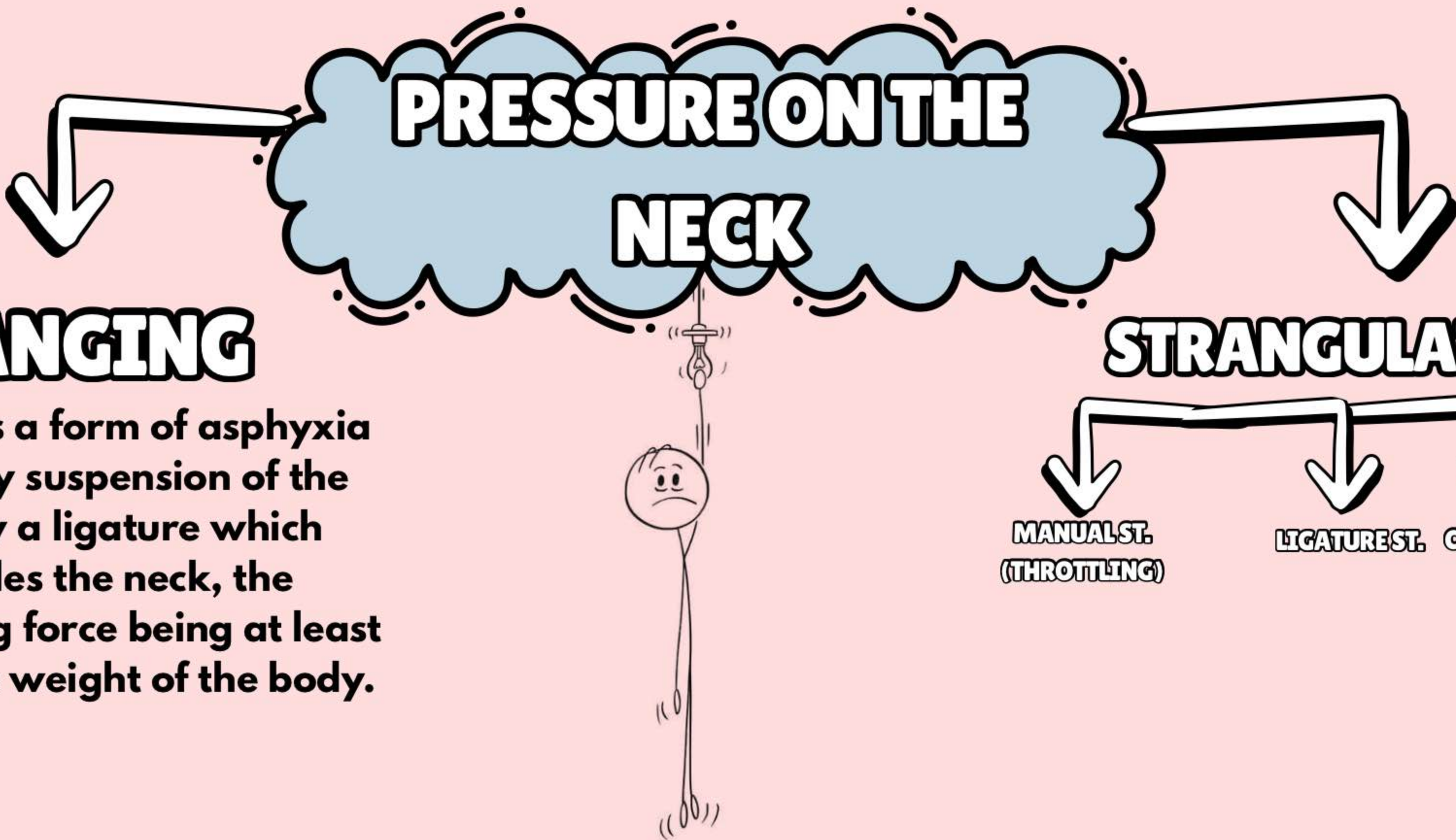
refers to the classical appearance of: A. Florid red or blue congestion of face and neck with variable involvement of the upper thorax, back and arms.

b. Deep cyanosis of face.

c. Numerous petechial hemorrhages or ecchymoses.

d. Demarcation line: Level of compression is indicated by a well- defined demarcating line between the discolored upper portion of body and the lower normal part





PRESSURE ON THE NECK

HANGING

Hanging is a form of asphyxia caused by suspension of the body by a ligature which encircles the neck, the constricting force being at least part of the weight of the body.

STRANGULATION

**MANUAL ST.
(THROTTLING)**

LIGATURE ST. CHOCKHOLDS

TYPE 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.



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.



MEDICO LEGAL ASPECT

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.

MEDICO LEGAL ASPECT

3-HOMICIDAL: VERY RARE EXCEPT IN NARCOTIZED OR UNCONSCIOUS VICTIMS AND POST-MORTEM SUSPENSION TO SIMULATE SUICIDE.

HOMICIDE SHOULD BE SUSPECTED WHERE:

I. THERE ARE SIGNS OF VIOLENCE/DISORDER OF FURNITURE

II. CLOTHING OF DECEASED IS TORN OR DISARRANGED

III. THERE ARE INJURIES, EITHER OFFENSIVE OR DEFENSIVE.

4-JUDICIAL H. FOR JUDICIAL EXECUTION



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 ♦ Direction ♦ Continuity ♦ Level in the neck ♦ Parchmentization ♦ Vital reaction	Oblique Non-continuous Above thyroid Present Present	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 ♦ Above ligature mark ♦ In lower limbs ♦ Glove-stockings like	Present Present Present	Absent Absent Absent
6.	Evidence of injury ♦ Self-inflicted ♦ Struggle ♦ Tear of carotid artery intima ♦ Imprint abrasion	Present Absent Present Present	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

I. Immediate causes

Asphyxia: Constricting force of ligature causes compressive narrowing of laryngeal and tracheal lumina, leading to asphyxia. **Venous congestion:** Jugular veins are blocked by the ligature which results in stoppage of cerebral circulation; **Cerebral anemia Reflex vagal inhibition** leading to sudden cardiac arrest. **Fracture/dislocation of cervical vertebrae:** It is seen in judicial hanging.

Delayed deaths are rare which may be due to:

Aspiration pneumonia

Edema of lungs, larynx

Infections

Infarction of brain

Hypoxic encephalopathy

Abscess of brain.

Fatal period: Death is immediate, if cervical vertebrae are fractured or if the heart is inhibited, rapid if cause is asphyxia and least rapid if coma is responsible. Usual period is 3–5 min which may extend to 5–8 min of suspension leading to death

External Findings

Postmortem findings

1. Face :

Prominent eyeballs

Protrusion of tongue

Bleeding from nose/ears

Dribbling of saliva: due to pressure on the submandibular glands.

Dilated pupils: If the knot presses on cervical sympathetic, eye of the same side may remain open and pupil is dilated (la facie sympathetique) It indicates antemortem hanging

2. Neck

A. Ligature mark ('furrow')

o Shown as an oblique , incomplete mark situated high up in the neck above the thyroid cartilage if the knot is fixed , but in case of slipknot it become complete.

o It take an inverted v- shaped at the apex & V at the point of suspension

o The mark is deepest opposite the point of suspension o It may be indefinite if the rope is broad and soft e.g. a piece of clothes.

may be distended

C. Dimension of neck: Due to prolonged suspension, the neck becomes slender and increases in length

D. Bending of neck: Neck gets flexed to the side opposite to the knot

3. Other parts of body
In males, there may be penile turgidity and involuntary discharge of semen
In both sexes, there may be an involuntary discharge of fecal matter and urine

Postmortem findings

Internal signs

Neck

Transverse carotid intimal tears

Hyoid bone may be fractured (anteroposterior ; outward compression fracture) Vertebral artery injuries—rupture, intimal tear

Larynx and trachea are congested.

Lungs

They are congested, distended and emphysematous with plenty of

Tardieu's spots subpleurally

Brain

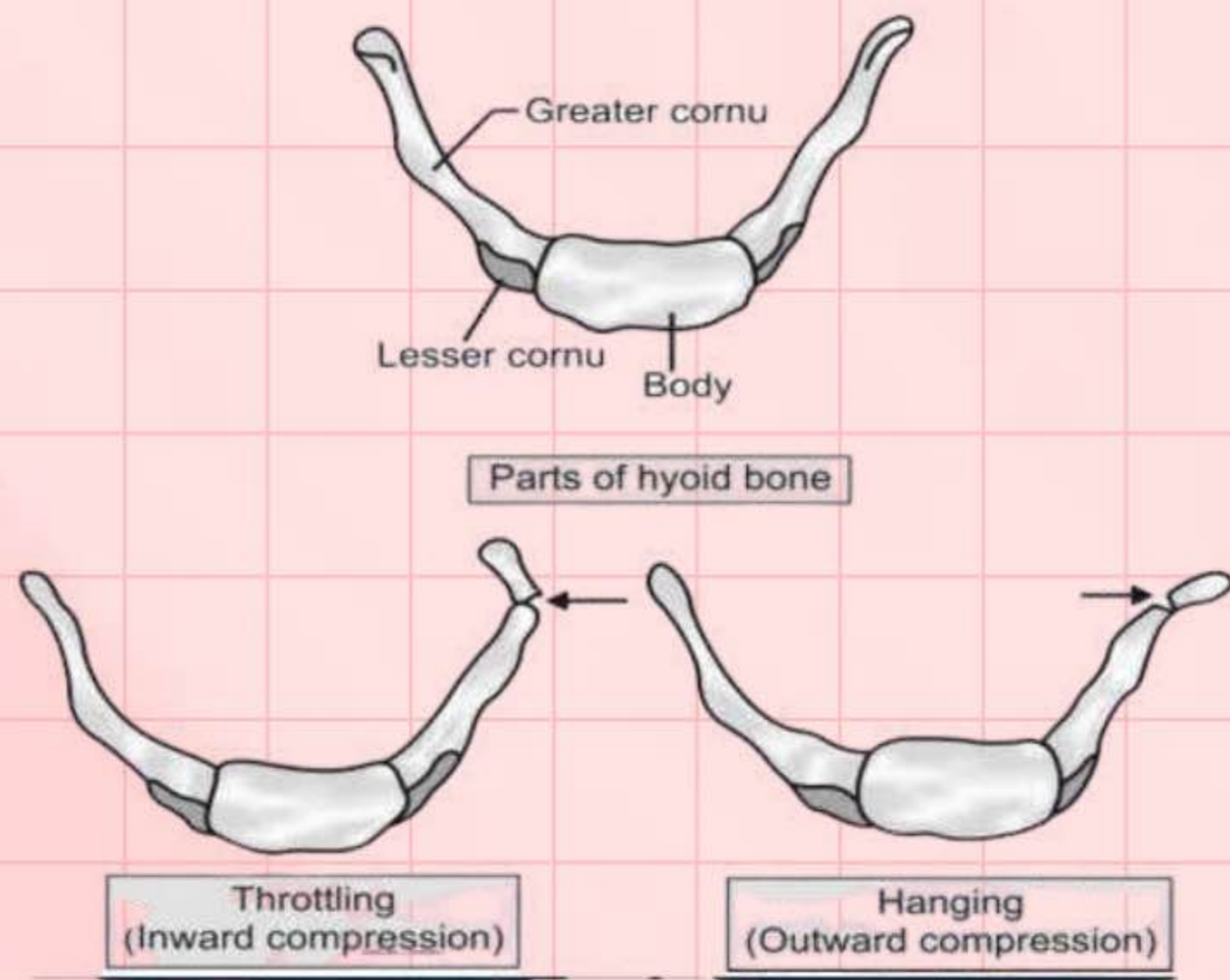
Congested and shows multiple petechiae

Viscera

All the abdominal organs are congested

Blood:

Fluid and purplish in color.



Ligature mark



Le facie sympathique



Ligature mark&cyanosis



Strangulation

It is a form of violent asphyxial death caused by constriction of air passage at the neck by means of a ligature or by any means other than suspension of the body.

Classification:

- Ligature strangulation
- Muggin: Manual strangulation or throttling



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Ligature strangulation

Pressure on the neck by a constricting band that is tightened by a force other than a body weight.



External Findings

Postmortem findings

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Protrusion of tongue

Bleeding from nose/ears

Dribbling of saliva: due to pressure on the submandibular glands.

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2. Neck

External local signs on the neck (Ligature mark)

- o **Groove present at the middle or lower part of the neck (below the larynx).**

- o **Completely encircles the neck or may be incomplete.**

- o **Usually transverse or may be oblique.**

- o **Usually take the shape of the rope.**
- o **May be faint (young & old & soft & removed immediately.) or very prominent (thin tough lig.)**

- o **Reddening & abrasions & petechial Hemorrhages are present along the edge of the mark.**

3. Other parts of body

In males, there may be penile turgidity and involuntary discharge of semen

In both sexes, there may be an involuntary discharge of fecal matter and urine

Postmortem findings

Internal signs

Neck

Fracture of thyroid cartilage, one or both the superior horns may be seen Bruising of the subcutaneous tissue and muscles of neck

Subcapsular and interstitial thyroid hemorrhages

Rings of trachea may sustain fracture

Lymphoid follicles at the base of the tongue and the palatine tonsils are congested Larynx, trachea and bronchi are congested

Lungs

They are congested, distended and emphysematous with plenty of

Tardieu's spots subpleurally

Brain

Congested and shows multiple petechiae

Viscera

All the abdominal organs are congested

Blood:

Fluid and purplish in color.

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Infarction of brain

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Abscess of brain.

2JINHT QJLFQ FXUJHY

Homicidal strangulation :Strangulation should be assumed to be homicidal ,until the contrary is proved.

Homicide is suspected when:

There are two or more firm knots, each on separate turns of the ligature.

Abrasions and fingernail marks are seen.

The clothing of the victim is torn or disarranged, indicating that a struggle has taken place.

The ligature when removed is loose.

Accidental strangulation

Accidental strangling may occur in uterus, when the movement of fetus causes the umbilical cord to encircle the neck.

Suicidal strangulation

The ligature should be found in situ; body should not show any signs of violence or marks of struggle. Laryngeal fractures are rare, and injuries are mild and often confined to the single ligature mark around the neck.

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
- Tor at least & minutes to cause death



1 -External Signs:

- a)General ext. Signs of asphyxia.
- b)External signs of resistance or struggle.
- c)External local signs on the neck- :
 - disc-like finger-tip bruises.
 - abrasion.
 - Linear finger nail scratches(assailant & victim.)

2 -Internal signs on the neck

(Dissection - :)Hemorrhages & bruises in deep structure of the neck muscles.

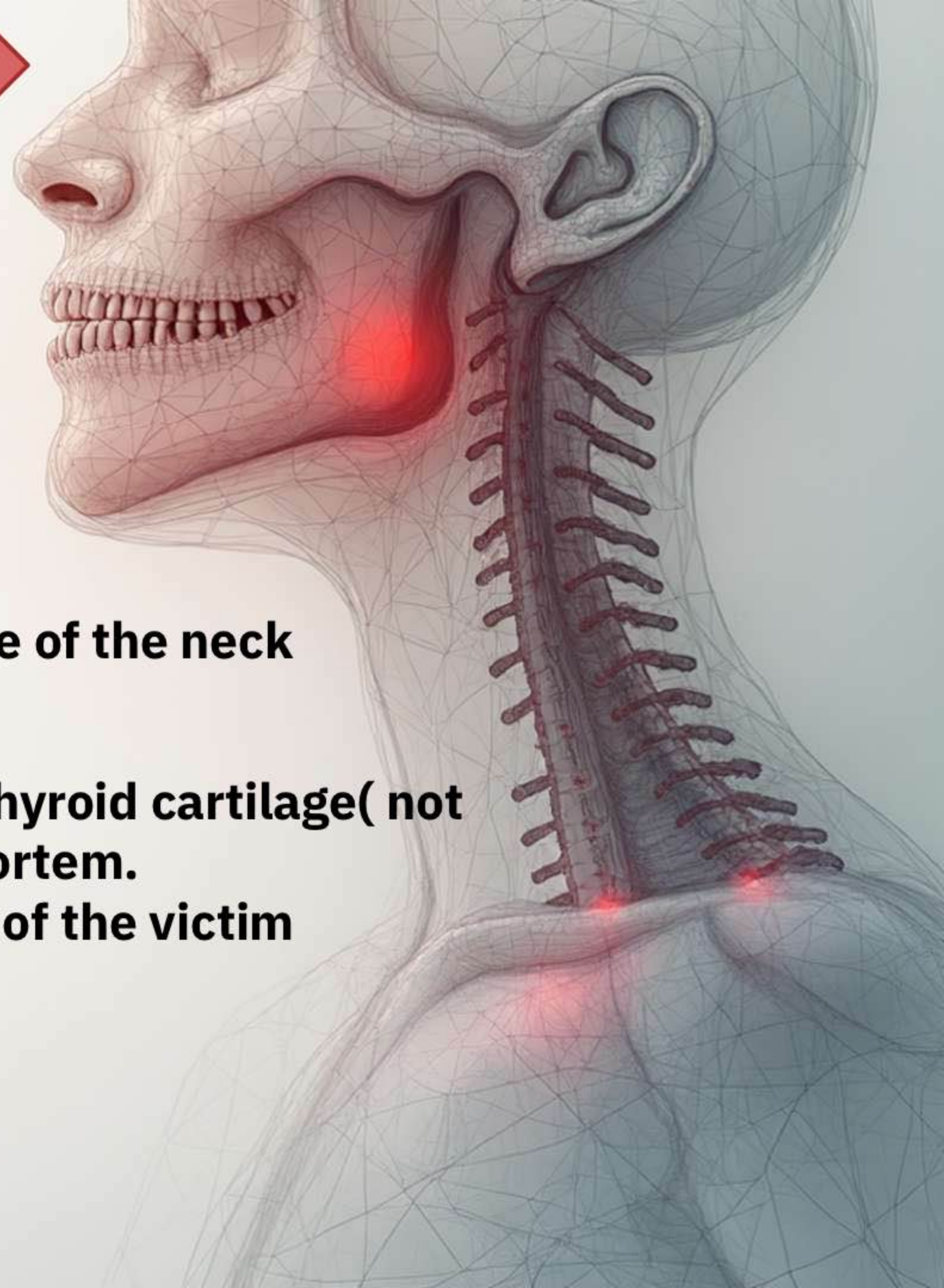
- Tears in the carotid artery.
- Fractures of the hyoid bone(inward fracture.)and or thyroid cartilage(not present in young .)D.D .between antimortem- & post mortem.

Ribs may be fractured, if murderer, kneels on the chest of the victim

Rarely→ no evidence

Mechanism of death

As in Ligature strangulation



Whether death was due to throttling?

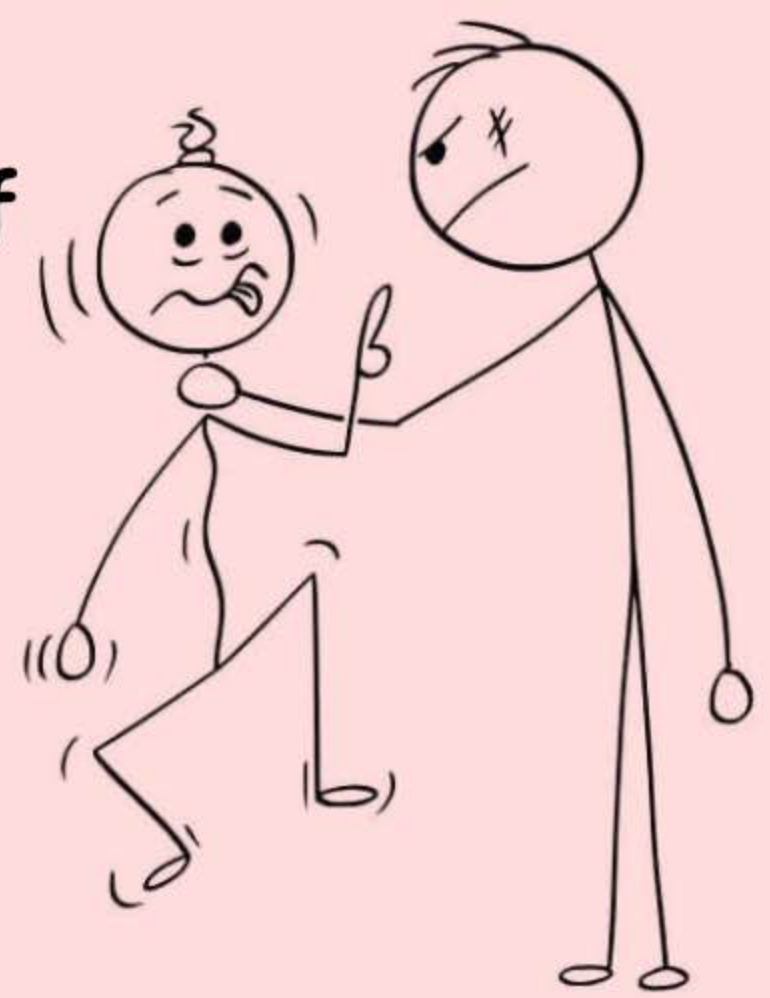
i. Bruising and abrasions on face and neck with or without rupture of neck muscles.

ii. Engorgement of tissues at and above the level of compression.

iii. Fracture of thyroid cartilages and hyoid bone.

iv. General signs of asphyxia.

v. Fracture of cricoid is almost pathognomic of throttling.



- Self-throttling is impossible, because as soon as unconsciousness supervenes, the hand will relax and the grip will be released.
- Accidental throttling: Sudden application of one or both hands on a person's throat as demonstration of affection, in joke or as a part of physiological experiment may cause death due to vagal inhibition.
- Homicidal throttling: Common mode of homicide



Mugging (arm-lock)

Compression on the neck produced by forearm or arm leading to holding the neck in the bend of the elbow.

On autopsy there are findings similar to ligature St. by aboard object





DROWNING

Form of violent

Asphyxial death due to the submersion of the mouth
and nostrils in a liquid medium

Drowning

Primary/Typical/Wet drowning

- Fresh water drowning
- Salt water drowning

Atypical drowning

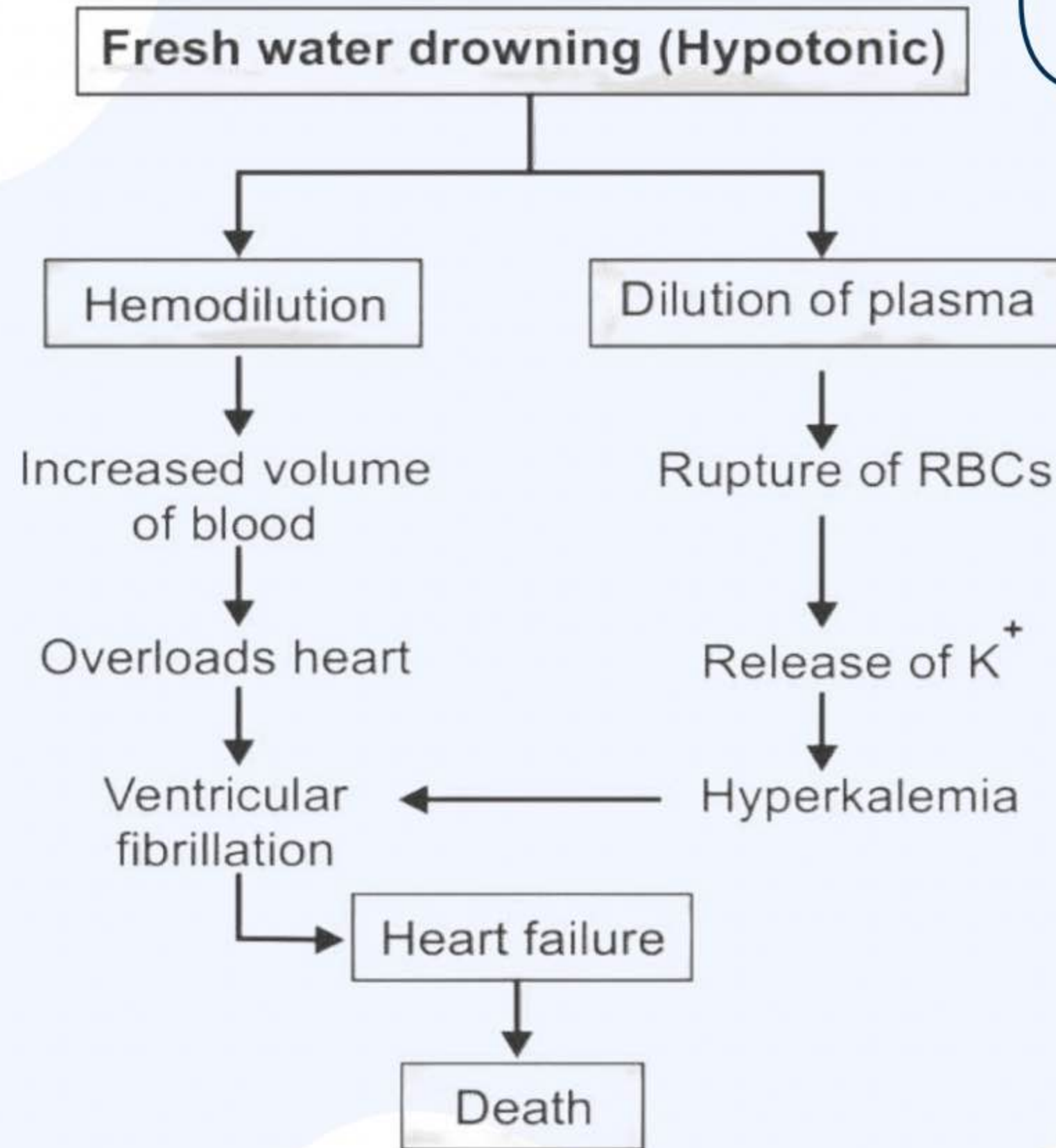
- Dry drowning
- Immersion syndrome
- Secondary drowning
- Shallow water drowning



I. Typical or Wet Drowning

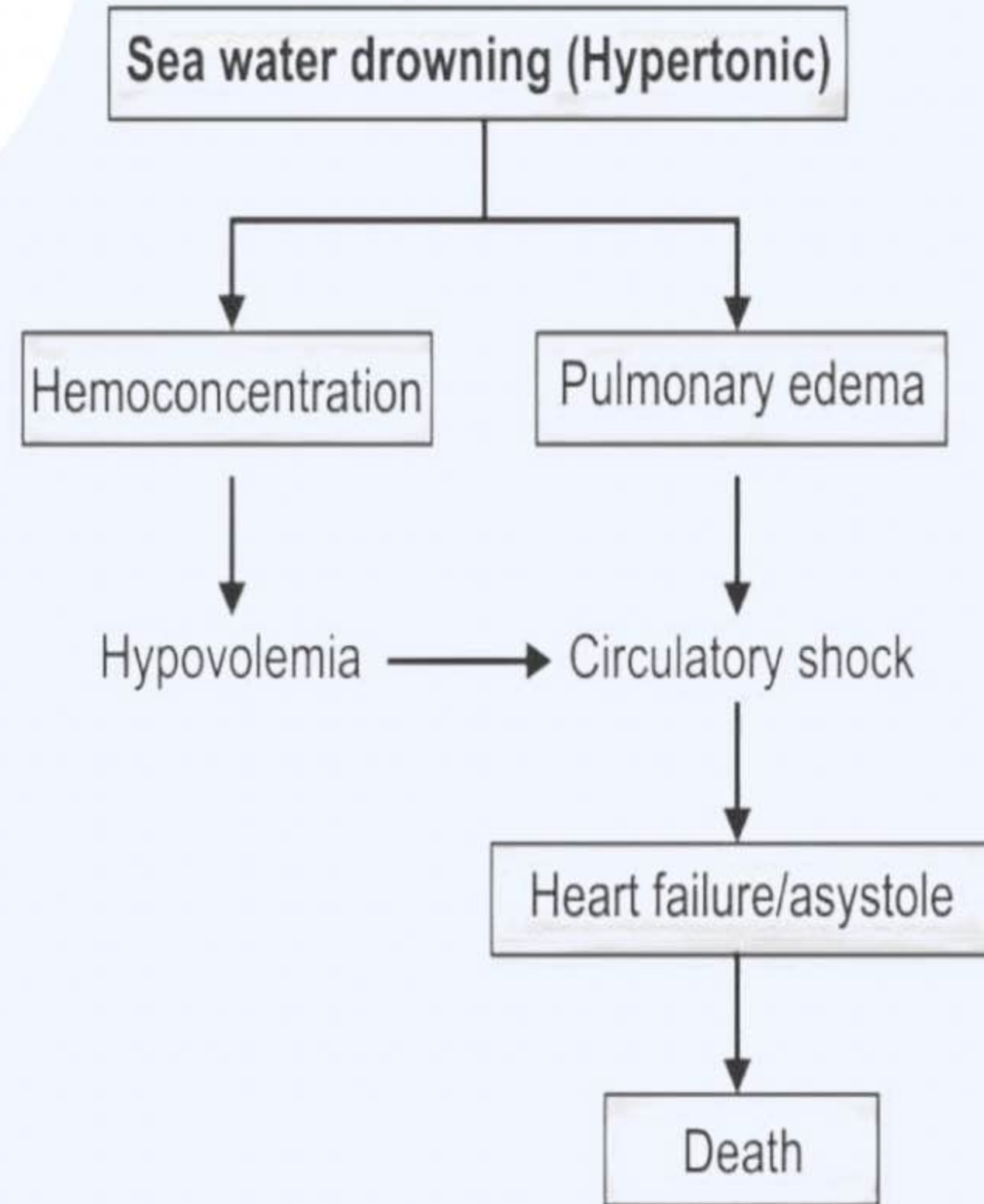
Water is inhaled into the lungs

In fresh water and brackish water drowning (0.5–0.6% NaCl), the aspirated water is rapidly absorbed from the alveoli into the circulation leading to hemodilution and hemolysis. Circulatory overload, hyponatremia, hyperkalemia, together with myocardial hypoxia result in fall of systolic blood pressure followed by ventricular fibrillation death in 4-5 min



I. Typical or Wet Drowning

In sea (salt) water drowning (3–4% salinity), the aspiration of water results in withdrawal of water from the pulmonary circulation into the alveolar spaces as a result of the osmotic differential, while at the same time electrolytes (sodium, chloride, magnesium from sea water) pass into the blood. There is hemoconcentration with crenation of RBCs, but not hemolysis and little change in the sodium/ potassium balance.^{31,32} The pulse pressure decreases slowly and is followed by A-V dissociation, but not ventricular fibrillation



Postmortem picture of wet drowning

Probable external signs:

. Related to anoxic anoxia :

1 - cyanosis

. Related to presence of the body in water:

1- skin is pale&wet

2 - Goose skin

3 - Washerwoman skin

4 - Postmortem injuries

. Affection of postmortem changes due to presence in water:

1 - Cooling 2 - hypostasis

3 – adipocere 4 – putrefaction



Postmortem picture of wet drowning



Maceration of skin



Cutis
anserina or
goose flesh



Froth



Abnormal goose skin



Washerwoman skin



Adipocere

Postmortem picture of wet drowning

II-Internal signs

Air passages contain foam, water, mud, sand or aquatic weeds

Stomach: water in the stomach and duodenum is a significant sign of drowning and indicates that the person was alive when entered water

Heart: heart and great veins are dilated and engorged with fluid blood

Lungs

Macroscopically Lungs

1. They are voluminous, filling the thorax and covering the heart
2. They show rib impressions on the surface and do not collapse
3. Pale but may show mottling appearance
4. Feel doughy, pit on pressure and remain inflated and spongy to the touch.
5. On cutting the lungs, large amount of water, sometimes foamy oozing from the surface on squeezing

Microscopically

The alveoli are dilated, thinning of the walls and compression of the capillaries. In late stage, alveoli are ruptured. The microscopic picture differs according to the type of water, in sea water drowning the architecture of the lungs is better preserved. In fresh water drowning, lungs are over distended, alveolar walls are torn and structures are disrupted



Accidental drowning is most common
Suicide by drowning is fairly common in India,
especially among females
.Homicidal drowning is not very common,

