

# ASPHYXIAL DEATH



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# ASPHYXIA

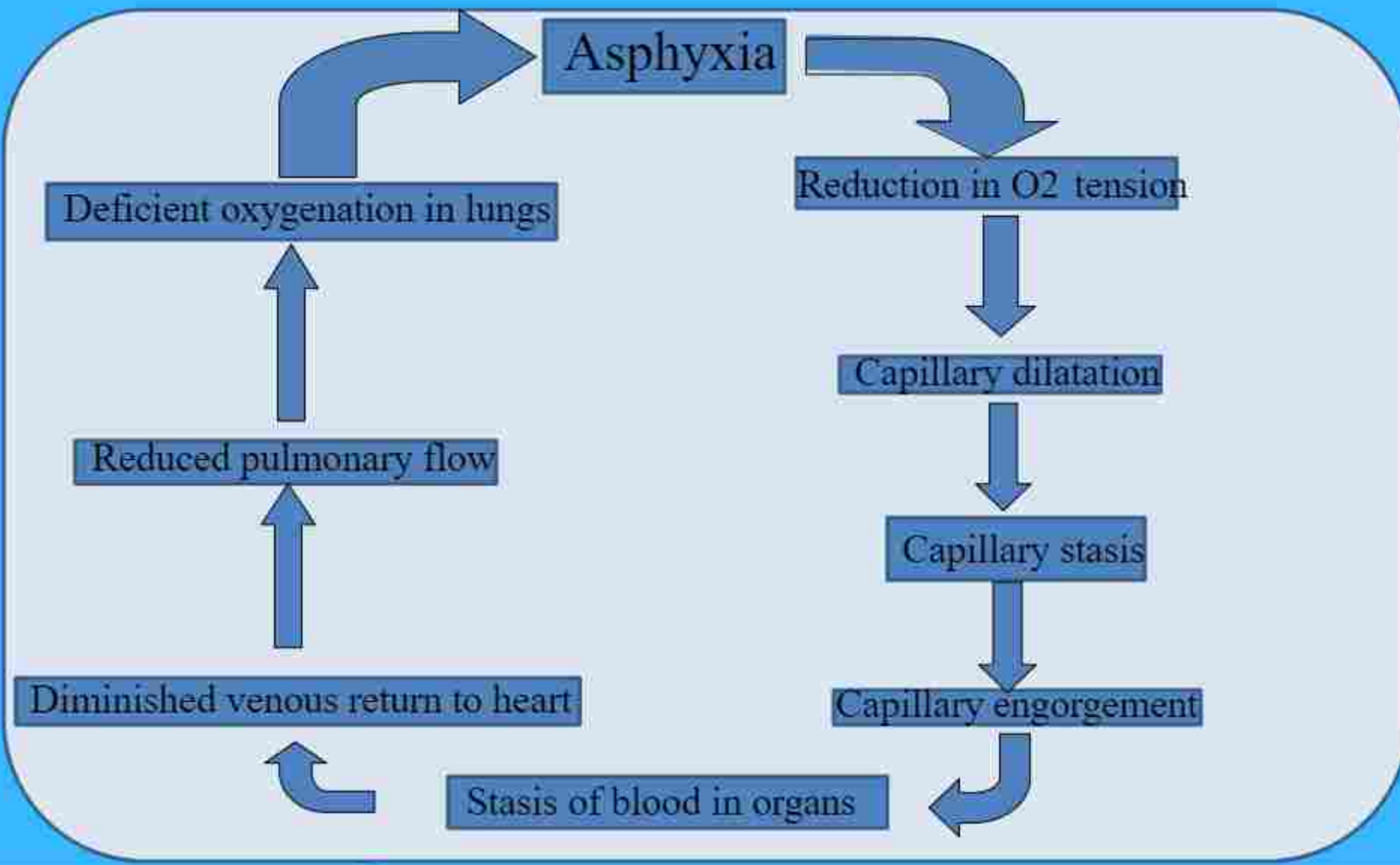
- Literally asphyxia means **absence of pulsation**
- It is a condition of decreased O<sub>2</sub> supply to the tissues
- Similar terms → anoxia, hypoxia
  
- The hindrance in oxygen transport can be:
  - Internal / External
  - Physical / Chemical
  - Atmospheric / Cellular
  - Due to any disease



# Classification

- **Environmental**
  - Low O<sub>2</sub> tension in air: ↓ O<sub>2</sub> supply
  - vitiated environment/ sewers / high altitude/wells
- **Mechanical**
  - Physical (force/obstruction) of various parts: ↓ O<sub>2</sub> supply
  - Hanging/Strangulation/Drowning/Traumatic/positional
- **Pathological**
  - Diseases → ↓ O<sub>2</sub> supply
  - Anemia/Pneumonia/Cardiac failure
- **Chemical**
  - Toxins/Poisons/Gases: ↓ O<sub>2</sub> supply
  - CO/Methane/H<sub>2</sub>S/Cyanide/Strychnine/Morphine

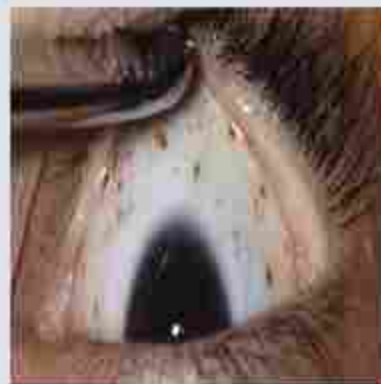




# Classic signs of asphyxia

- Congestion
- Edema
- Cyanosis
- Petechiae

**All these signs are only suggestive, not specific**



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# Mechanical asphyxia (External)

- **Smothering:** Obstruction over nostril and mouth
- **Hanging:** Neck pressure by force of own weight
- **Strangulation:** Neck pressure by an external force
  - Manual strangulation/Throttling
  - Mugging/Arm lock/Chokehold & Carotid Sleeper hold
  - Ligature strangulation
  - Garrotting
  - Bansdola
- **Traumatic asphyxia/Overlaying:** decrease breathing due to external force
- **Positional/Postural asphyxia:** ↓breathing due to body position
- **Mixed/Burking:** Smothering + Traumatic asphyxia



# Mechanical asphyxia (Internal)

- **Gagging:** Obstruction inside nose & mouth
- **Choking:** Obstruction at or below the larynx
  - Café coronary
- **Drowning:** Obstruction at the level of alveoli



# Suffocation

- Includes all forms of asphyxia by means other than constriction of the neck or drowning
  - Environmental asphyxia
  - Traumatic asphyxia
  - Positional asphyxia
  - Smothering
  - Gagging
  - Choking
- **A vague term usually reserved for environmental asphyxia**





# Smothering

- Asphyxia caused by mechanical occlusion of external respiratory opening
- Respiration is prevented by closure of mouth and nostrils
- **Mechanism of death**
  - Asphyxia due to **blockade of respiration**
  - **Reflex cardiac arrest**
- Manner of death determines postmortem findings



**Smothering**



# Manner of death

## Accidental

- Intoxicated/epileptic/unconscious persons sleeping in a prone position
- Burial by sand/mud during disasters
- Fetus born with intact amniotic membrane
- Children covering their heads with plastic bags while playing

## Homicidal

- By hand/pillow/plastic bags

## Suicidal

- Plastic bag/Burial



# Plastic bag asphyxia (Dry-submarino)



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# Postmortem Findings

Marked signs of asphyxia:

- **Person dying in a prone position**
  - Skin around the mouth and nose may appear pale due to contact pallor
  - Salivary secretions over a pillow
- **In cases of burial**
  - Sand and mud particles inside nose/ mouth/ respiratory tract





# Postmortem Findings

## In cases of homicidal smothering by hands

Around the mouth and nose

- Crescentic abrasions (Nail marks)
- Scratch marks on the nail
- Small ovoid contusions by fingertips Inner aspect of lips
- Torn frenulum
- Lacerations
- Contusions
- Abrasions





## Traumatic asphyxia



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# Traumatic asphyxia

- Restriction of respiratory movements due to compression/ mechanical fixation of the chest wall by external pressure/agent.
- Abdominal wall may or may not be compressed
- Actual injury need not be produced over the chest as the name implies
- **Signs of asphyxia are most pronounced**

## **Mechanism of death**

- Asphyxia due to the absence of respiratory movement



# Manner of death

## 1. Accidental

- Stampede in crowd
- Burial under soil/buildings at disasters
- Pressed by a heavy object as a vehicle/machine

## 2. Homicidal

- Kneeling down over the chest during a fight

## 3. Suicidal

- Rare

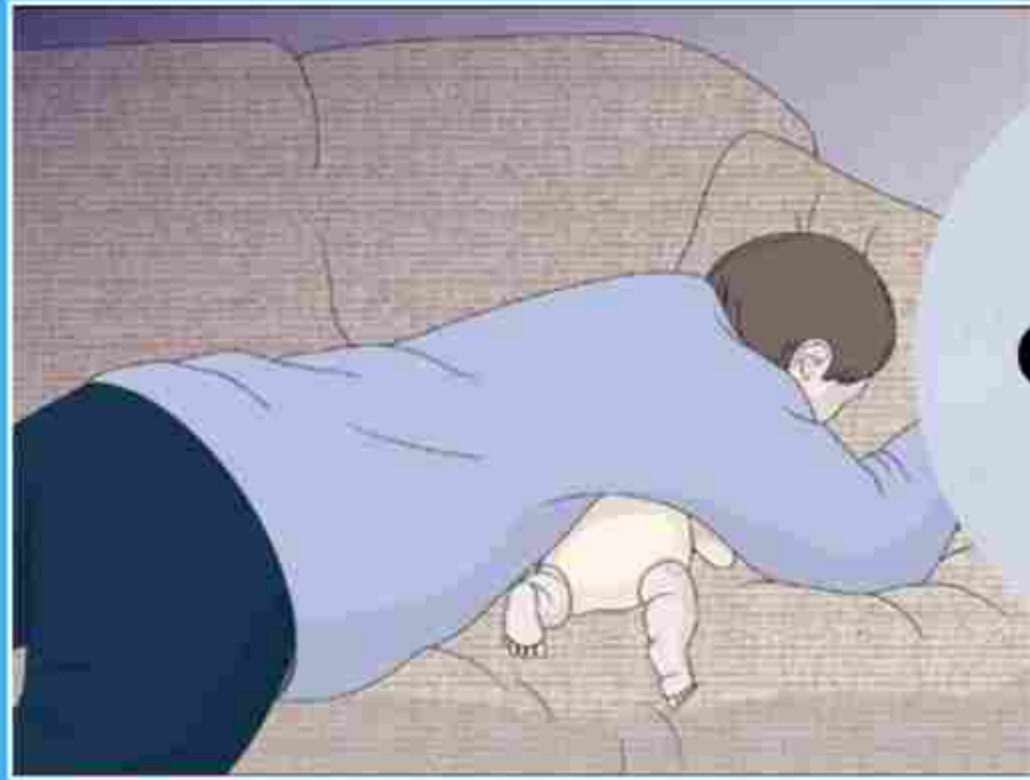




# Postmortem Findings

- External injuries over chest and abdomen by crushing agent
- Mud/sand present over the body
- Marked signs of asphyxia above the level of compression:  
**Masque Ecchymotique**
- Fractured ribs/Organ injuries due to compression
- Congestion and petechiae of internal organs  
pleura/pericardium
- Edema glottis





**Overlying**



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# Overlaying

- Usually accidental
- Traumatic asphyxia + smothering
- Children overlaid during sleep either by adults or by the heavy blankets
- Signs of asphyxia will be present at the autopsy





# Burking



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# Burking

- Homicidal
- Traumatic asphyxia by sitting/kneeling over chest + Smothering
- Signs of asphyxia present
- **Named after William Burke & William Hare who used to kill victims by this method**





# The legendary duo



Between 1827 and 1828 William Burke and William Hare murdered at



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## **Positional asphyxia**



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# Positional asphyxia

- Asphyxia due to certain body positions which causes **difficulty** in normal respiration
  - Bending of airway
  - Elevation of the tongue against the pharynx
  - Compression of chest and abdomen
- **Usually accidental in nature**
- **Common among alcoholics/mentally retarded/sub-conscious persons**
- **May occur when a person is trapped in an abnormal body position → ditch/trench/between the walls**

## **Mechanism of death**

- Asphyxia due to **restricted respiration**





# Postmortem Findings

- Typical scene of death
- Abnormal body posture
- Evidence of alcohol intake
- Marked signs of asphyxia



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- Form of asphyxia where a gag is stuffed into the mouth
- Nose need not be blocked
- A gag may be cloth/paper
- Initially airway is patent through the nose but gradual salivation and mucus secretion form a tight plug causing complete airway obstruction



**Gaggin**  
**g**



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# Postmortem finding and manner of death

- Usually homicidal sometimes accidental (burial)
- Done commonly with the intention of preventing the victim from shouting/calling for help
- May be associated with rape/torture
- Postmortem findings
  - Similar to **smothering**
  - Injuries over the mouth and nose may be sustained during forceful stuffing of a gag
  - Signs of asphyxia



# Choking

- Asphyxia caused by obstruction between larynx and tracheal bifurcation
- Usually accidental sometimes homicidal
- **Mechanism of death**
  - Vagal inhibition
  - Laryngospasm
  - Airway obstruction
  - Delayed infections
- **Common in children/epileptics/artificial dentures/injuries & surgeries of the oral cavity and nose/anaphylaxis/diseases of airway/vomit regurgitation in unconscious**







# Choking → Café coronary

- Accidental choking by food particles while eating symptoms may look like acute coronary syndrome
- **Predisposing factors**
  - Inadequate chewing
  - Poor cough/gag reflex
  - Intoxication/decrease consciousness level
- **Postmortem findings**
  - Asphyxial signs
  - Choking agent is present in the airway





## Chocking (Fish in Neck)



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# **Asphyxia By Pressure Over Neck**



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# Mechanism of death in pressure over neck

- **Airway occlusion (15 kg)**
  - Lifting up of the larynx causes the root of the tongue to press the pharynx
- **Jugular vein occlusion (2 kg)**
  - Classic asphyxial signs above the level of compression
- **Carotid artery occlusion (5 kg)**
  - Rapid unconsciousness if bilateral occlusion
- **Pressure on the carotid sinus**
  - Reflex cardiac arrest and immediate death
- Fractures/Dislocation/Subluxation of cervical vertebrae
- Hanging with jerk/jump & anterior knot position **vertebral artery occlusion (30 kg)**
- Rare mechanism





# Hanging

Form of asphyxia due to ligature pressure over the neck derived from the complete or partial weight of the body

Or,

Form of asphyxia where the body is suspended by a ligature material tied around the neck, force of neck constriction being complete/partial weight of the body

- **Hanging ≠ self-suspension**
- May be suicidal/homicidal/accidental



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# Hanging (Complete suspension)

- No part of the body is supported or touching the ground
- Complete body weight provides constricting force over the neck



## Hanging (Partial suspension)

- Some part of the body is supported or touching the ground
- Part of the body weight provides constricting force over the neck
- Sitting/kneeling/lying down/prone position





**Even weight of head alone  
can provide sufficient constricting  
force to cause death by hanging**



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## Typical Hanging



**Knot over occiput**

## Atypical Hanging



**Knot over places other than occiput Sides/Front**



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# Manner of death in hanging

- **Suicidal**
  - Unless proved otherwise
- **Homicidal**
  - If the assailant/s over powers the victim
  - If the victim is subconscious
- **Accidental**
  - Children while playing
  - Industrial accidents where scarf, tie etc. gets entangled in machinery



# External PM findings

## Ligature material over the neck

- If not already removed

## Ligature mark over neck Inverted 'V-shaped

- Usually higher up around the neck
- Runs obliquely upward towards the knot/suspension
- More horizontal in case of partial suspension
- More prominent just opposite to knot
- Appearance depends upon duration of the suspension, type of ligature material, type of hanging
- Initially pale depressed but later on brownish due to drying





Ligature mark over neck Inverted 'V' shaped.



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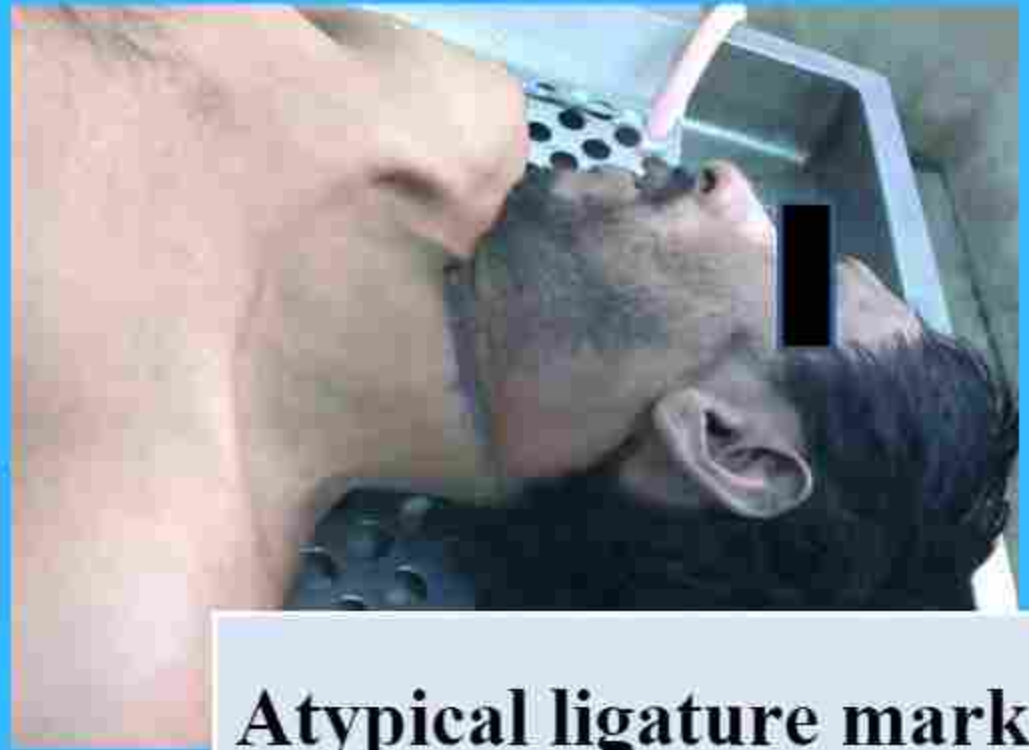
**Appearance of ligature mark  
depend upon many factor**



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**Atypical suspensions**



**Atypical ligature marks**



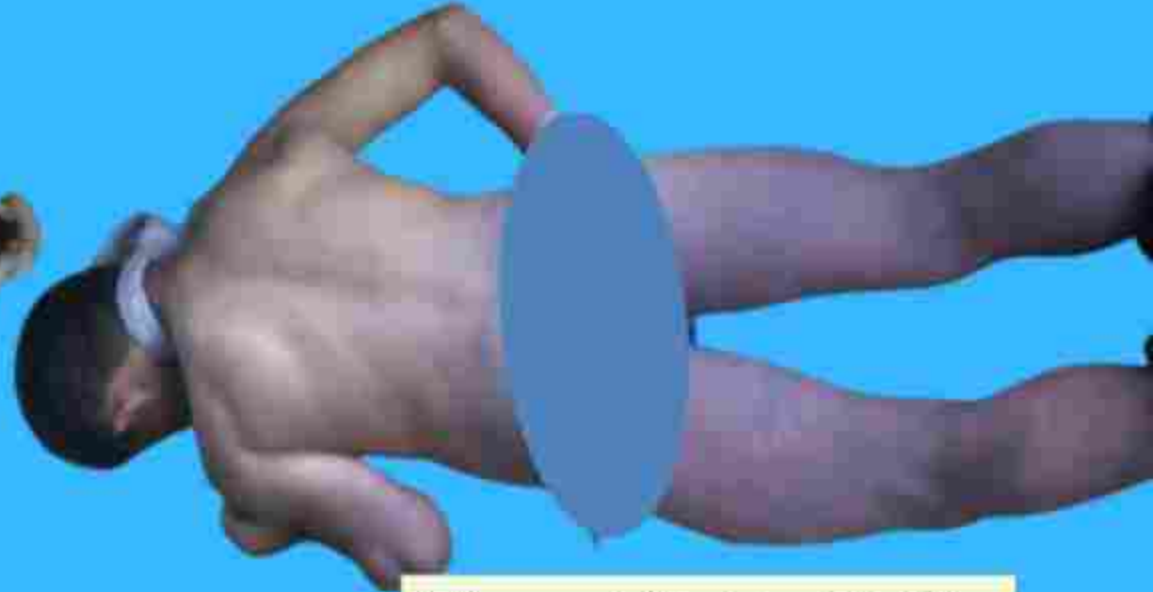
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- **Very few other external neck injuries** **Signs of asphyxia (Partial suspension)**
  - Congested swollen face
  - Petechial haemorrhages **Tardieu Spots**
  - Cyanosis of fingers
- **Protruded / Dried / Bluish tongue**
  - Upward pressure over the floor of mouth **Salivary dribbling from the mouth**
- Opposite the site of the knot
  - Unilateral pupillary dilatation **La Facie Sympathetique**
- Same side of the knot **Elongation and bending of the neck**
- Prolong suspension



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# AM Hanging



Glove and Stocking Lividity



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**In prolong  
suspension**

**Tardieu  
Spots**



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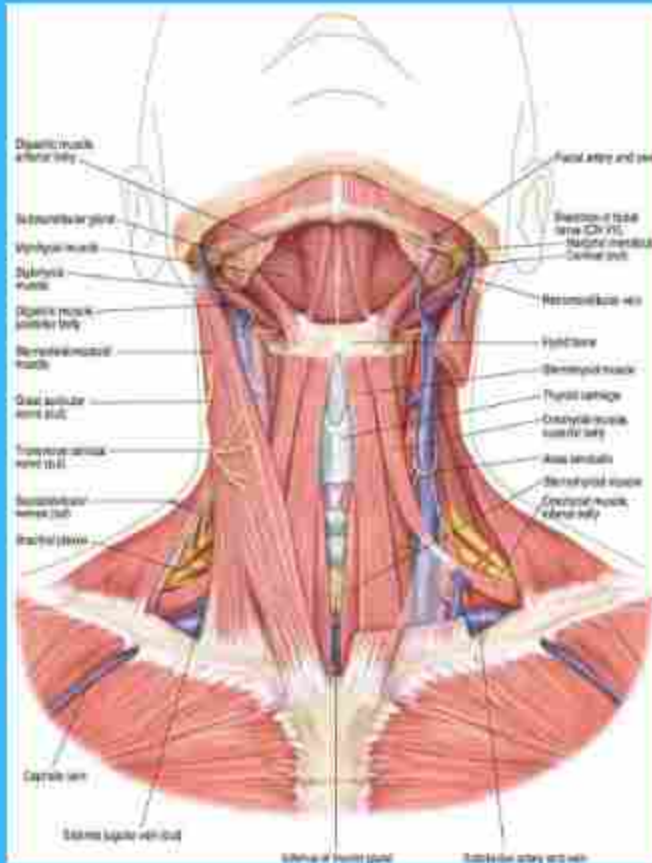
# Non specific findings

- Clenching of hands
- Discharge of genital fluids
- Discharge of urine and stool
- Froth from mouth



# Neck Dissection

Blood-less / In-situ / Layer-wise



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**Minimal  
muscle  
hemorrhage**



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# Internal PM findings

- Subcutaneous tissue beneath the ligature mark is dry, glistened, whitish and firm **Argent line**
- Hemorrhages over the lower attachment of sternocleidomastoid and strap muscles
- Transverse carotid tears **Amussat's sign**
- Fracture of greater horns of the thyroid cartilage and hyoid bone is an uncommon finding in hanging which is common in elderly
- **Less extensive internal neck injuries**



# Other findings

The original Tardieu spots

- Sub-pleural petechiae
- Bowel wall haemorrhages
- Congestion and petechiae of all the internal organs  
brain/pericardium
- Hemorrhages between an anterior longitudinal ligament and intervertebral discs of lumbar spine

**Simon's sign**



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# Judicial Hanging

- For capital punishment
- Neck tied and person stands on a trapdoor
- Trapdoor suddenly opened
- Complete **hanging** with a jerk
- Knot placement anterior **below the chin**
- Sometimes knots placed over sides
- Fracture /Dislocation C2 – C3 / C3 – C4 **Hangman's Fracture**
- Stretching and laceration of the spinal cord
- **Rapid death**

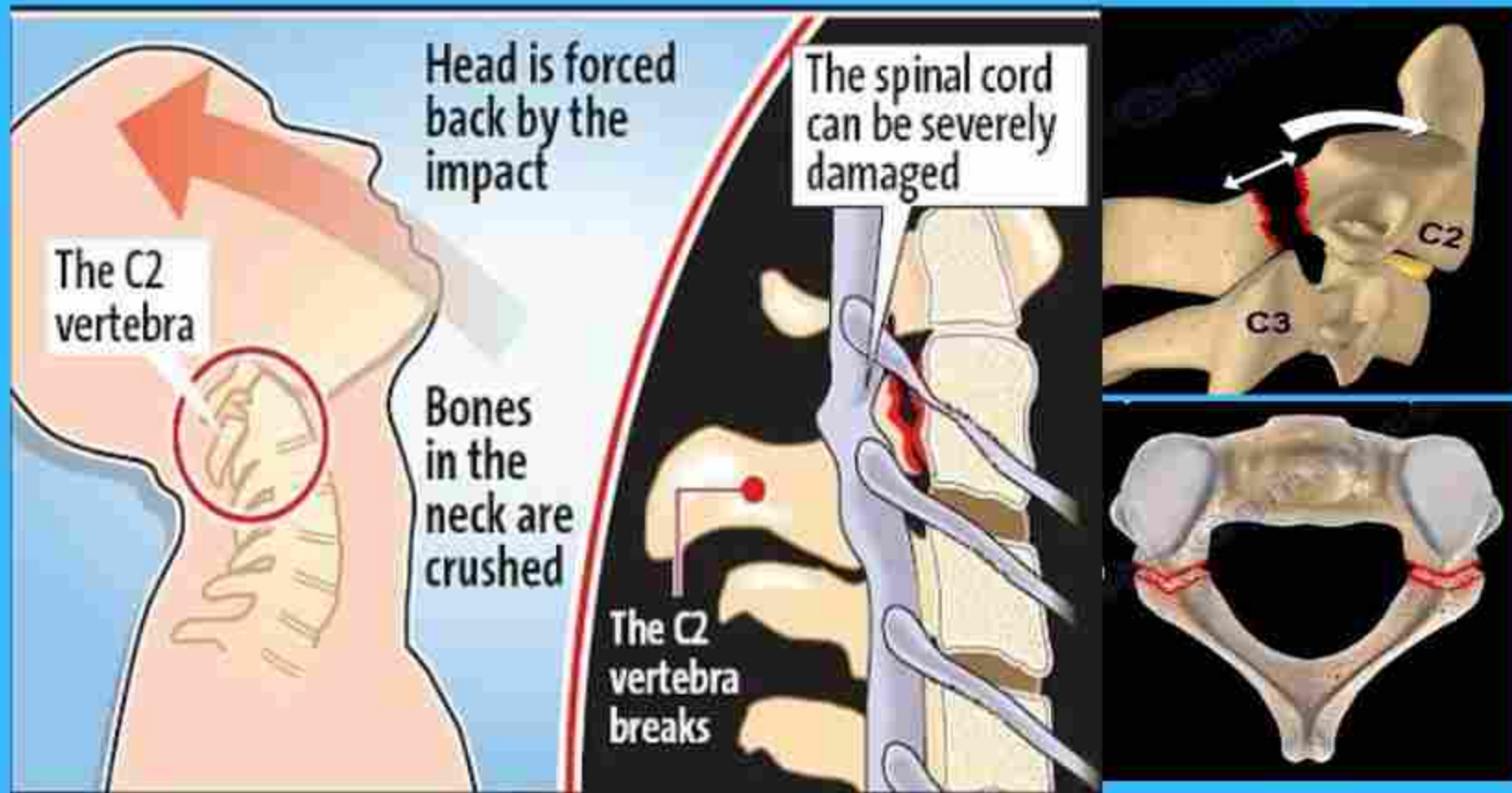


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# Axis (C2) bilateral Pedicle fracture

## HANGMAN'S FRACTURE





# Extrajudicial Execution

## LYNCHING

- Illegal homicidal hanging
- Hanging someone without legal proceedings
- Assailants are a group of people who provide justice in their own way
- Victim is an accused/enemy/suspect of any social crime
- May be a result of various civil war
- Practiced formerly in North America where Whites used to hang Negroes



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# Usual scenario in hanging death

- A person having a history of depression/failure in life or love who might have tried suicide earlier by various methods, is found suspended by rope inside a room closed from inside/at lonely places such as jungle or unoccupied places.
- The scene of death is undisturbed and clean. There may be some suicide notes or other writings expressing frustrations in life.
- Body may show tentative cuts over wrists/neck with minimal other injuries.
- A ligature mark over the neck with or without some nail marks.
- Minimal injuries over internal neck structures. Non-specific congestion and petechiae of internal organs.



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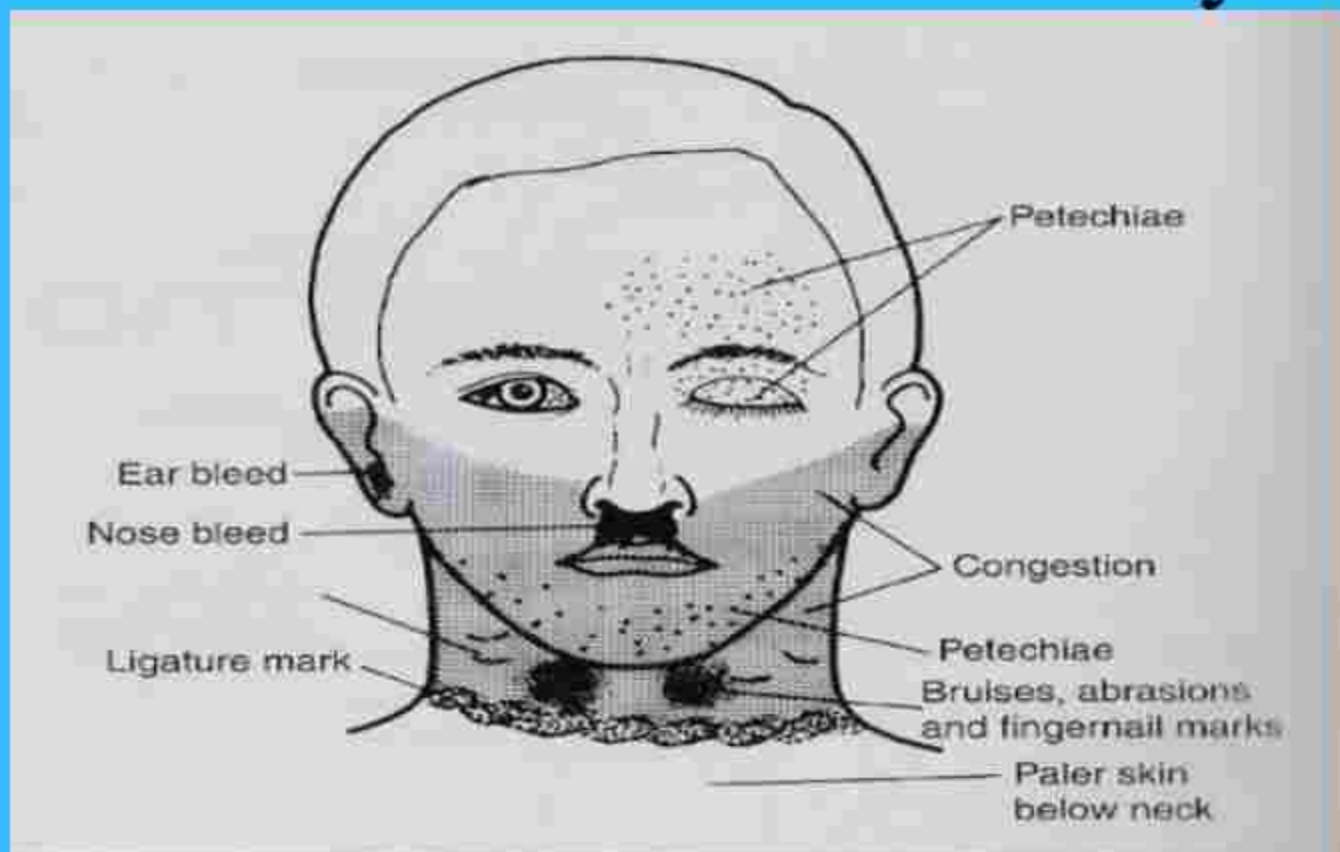
# Strangulation

- A form of asphyxia caused by pressure over the neck by force other than body weight
  - **Ligature – Manual – Mugging – Garrotting – Bansdola.** So, hanging is a form of ligature strangulation where
  - force is derived from the gravitational drag of the complete or partial body weight
  - Mechanism of death → Same as in hanging
  - Manner of death → Homicidal > Accidental > Suicidal
- Signs of asphyxia are more marked than in hanging**





# Classical features of strangulation when cardiac arrest is delayed



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# Ligature strangulation

- Asphyxia due to constriction of the neck by a ligature material by force other than the weight of the body
- Usually homicidal but may be accidental and rarely suicidal
- **Classic features of asphyxia are overwhelmingly present above the level of constriction/Face**
- Mechanism of death → As in hanging



# Ligature strangulation



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# External PM findings

## Facial features

- Marked congestion/cyanosis/oedema
- Multiple petechiae over face/conjunctiva
- Bleeding from nose/ear/mouth prominent eyes
- Protruded tongue Ligature mark around the neck
- Horizontal
- Lower down on the neck (at/Below adam's apple)
- Completely encircles the neck
- Sometimes crossing of two ligature marks
- May be patterned





# Ligature material in situ



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# Ligature mark in strangulation



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# Nasal bleeding / Eye Petechiae



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# Other external features

- Disturbance of crime scene with signs of struggle
- Tearing of clothes during a struggle
- Deep purplish postmortem staining
- Abrasions over the neck due to assailant or victim
- Associated smothering injuries
- Defence injuries over different body parts of a victim during the struggle
- Genital injuries due to associated sexual violence
- Any other injuries over any body parts



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# Internal PM findings

## Neck findings

- Hemorrhage and tears of soft tissue and muscles just beneath ligature mark and knot
- Fracture of the thyroid cartilage and hyoid bone uncommon
- Deep penetrating thin ligature material may cause carotid intimal tears
- Contusion of the root of the tongue & floor of the mouth
- Ecchymosis/Petechiae/oedema of the mucosal lining of the larynx
- Non-specific congestion/oedema/petechiae of different organs as in hanging



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# Hemorrhage over soft tissue around hyoid bone and mucus lining of larynx



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# Manner of death

- Commonly homicidal
- **Accidental**
  - In factories where a tie/scarf etc. gets entangled in machinery
  - Children while playing
  - Fetus by an umbilical cord
- **Suicidal**
  - When a wet ligature material is used especially by making multiple knots
  - Ligature material is usually found in situ



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# Manual strangulation (Throttling)

**Asphyxia**  
due to  
**Constriction of**  
**neck**  
by  
**Hands**



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# External PM Findings

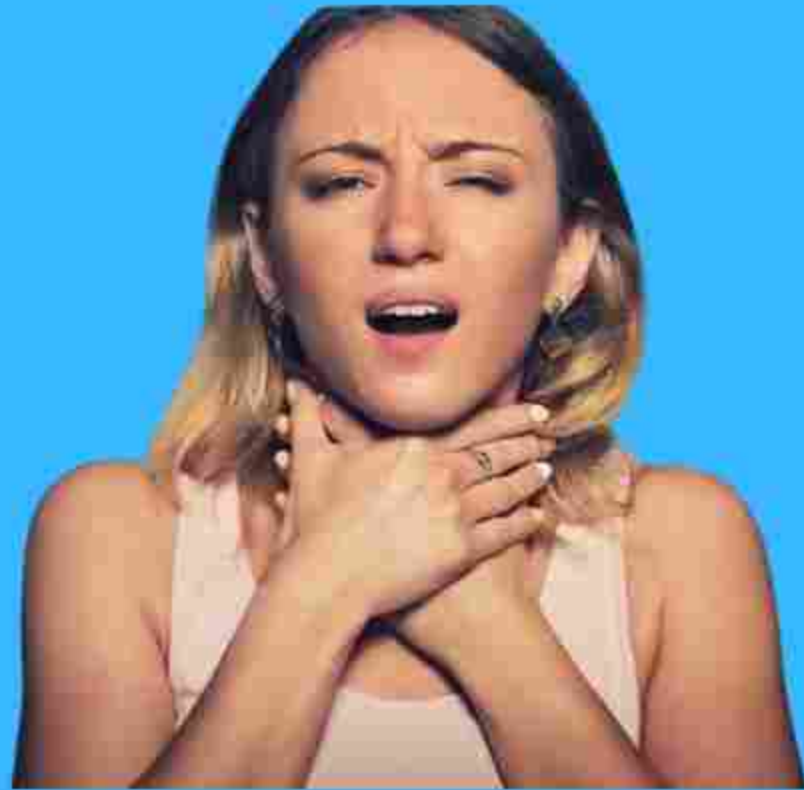
- Disturbed scene of death
- Signs of asphyxia over the face
- Defense injuries over other body parts
- History is suggestive in many cases of **Neck injuries**
- Discoid/Ovoid bruises over the neck
- Crescentic/Linear nail abrasions over the neck
- Sometimes small lacerations

Almost always homicidal rarely accidental but never suicidal



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Suicidal throttling can not happen because as soon as unconsciousness occurs the grip of hand becomes loose and the person regains consciousness



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## Multiple neck injuries

- Bruises
- Abrasions
- Lacerations

All caused by offending hands



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Findings are usually bilateral



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# Internal PM Findings

- Hemorrhage/Contusion/Tears in soft tissues, beneath the external injuries
- Muscle bleeding at various depths and places
- **Inward fracture of the hyoid bone**
- **Fracture of the greater horn of thyroid cartilage**
- Edema and reddish petechiae over the mucus lining of larynx/epiglottis/pharynx
- Carotid injuries are not so common

Both external & internal neck injuries are most extensive in manual strangulation



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# Neck muscle contusions



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# Fracture of hyoid bone



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# Medico-Legal issues

- Suicidal throttling is impossible
- Accidental throttling death can occur by reflex cardiac arrest
- Often associated with robbery/sexual assault
- Injuries to various neck structures may point to the amount of force applied
- Direction of attack and handedness of the assailant cannot be accurately made out from the pattern of injuries



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Trait	Hanging	Strangulation
Ligature mark	Oblique, incomplete, high in the neck	Transverse, complete, mid level or below thyroid cartilage
Base	Pale, hard, parchment like	Contused
Abrasion, contusion & Echymosis	Less prominent	More prominent
Hyoid fracture	More common	Less common
Thyroid cartilage	Less common	More common



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Trait	Hanging	Strangulation
Carotid	Intimal tear	Not seen
Signs of asphyxia	Less marked	More marked
Dribbling of saliva	Often	Rare
Bleeding from nose, mouth & ears	Rare	Often
Involuntary discharge	Occasional	Frequent
Manner	Suicidal	Homicidal
Injuries on other body parts	Rare	Common



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# Mugging/Arm lock

- Strangulation by Arm / Forearm / Bent elbow
- **Types**
  - Tracheal choke / Air choke → Airway compression
  - Carotid sleeper/Blood choke → Carotid compression
- **Uses**
  - Police to restrain criminals
  - During fights
  - Combat sports



Can cause intentional/unintentional deaths due to asphyxia



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**Blood choke (Sides of neck compressed)**



**Air choke (Front of neck compressed)**



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# Garrotting

- Ligature strangulation where a stick or rod is used to twist the ligature material to constrict the neck
- Mechanism of death/Postmortem findings
  - Similar to ligature strangulation
- Manner of death
  - Homicidal
- Used as a method of judicial execution previously in Spain



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Garrote (which is used for garrotting)



Garrote (Spanish wind lash) Neck compression + Spinal cord injury



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# Judicial Garrotting



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# Garrotted by Electra King



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# Bansdola

- Strangulation by bamboo/stick
- Victim attacked from behind
- Similar to chokehold
- Usually homicidal



Commonly the neck is compressed between sticks placed at the front and back

- Sometimes stick is used only anteriorly while the foot or any other thing supports the back of the neck



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A photograph showing a person's hands and forearms emerging from dark, choppy water. The hands are raised, and there is a significant splash of white water around them. The background is a hazy, overcast sky. The text "IMMERSION DEATHS" is overlaid in a bold, red, serif font across the middle of the image.

**IMMERSION DEATHS**

# Drowning

- Drowning is a form of asphyxia due to submersion in any liquid medium, usually water
- In many cases drowning is a diagnosis of exclusion, in dead bodies that are retrieved from water, where no other significant cause of death can be ascertained
- Accidental > Suicidal > Homicidal



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# Not all bodies recovered from water have drowned

- Natural disease before falling into the water
  - Natural disease while in water
- Injuries before being thrown into the water
  - Injuries while in water
- Effects of immersion other than drowning
  - Immersion syndrome/Hydrocution/Submersion inhibition
  - Near drowning/Secondary drowning/Post immersion syndrome
- Drowning
  - Typical drowning/Wet drowning/Primary drowning
  - Shallow water drowning
  - Dry drowning



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# Immersion syndrome

- **Caused due to**
  - Diving on foot/epigastrium/back
  - Sudden exposure to cold water
- Inrush of cold water in eardrum/nose/pharynx
- **Mechanism of death**
  - Vasovagal cardiac arrest
- **Risk increased by**
  - Alcohol/Old age/Preexisting heart disease



# Dry drowning

- Caused by:
  - Sudden inrush of water into the larynx
- **Mechanism of death**
  - Severe laryngospasm
  - Vasovagal cardiac arrest
- Actual plug of mucus/foam/froth may be formed
- **Death is rapid**
- Lungs are relatively dry



# Near drowning

- Submersed person resuscitated and survives for at least 24 hours
- May die later due to complications
  - Electrolyte imbalance
  - HIE
  - ARDS
  - Pneumonia
  - DIC
- Survivors may suffer neurological deficits



# Shallow water drowning

- Drowning in a shallow water pit/drain/trench
- Immersion of nose and mouth is all it takes to die out of drowning
- Common among
  - Alcoholic
  - Children
  - Epileptics
  - Drugged
- Cannot revive themselves from a trivial situation



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# Typical drowning/Wet drowning/ Primary drowning

- Water is inhaled into the lungs and reaches the bronchi and alveoli
- Mechanical blockade of respiration at the alveolar level

## Types

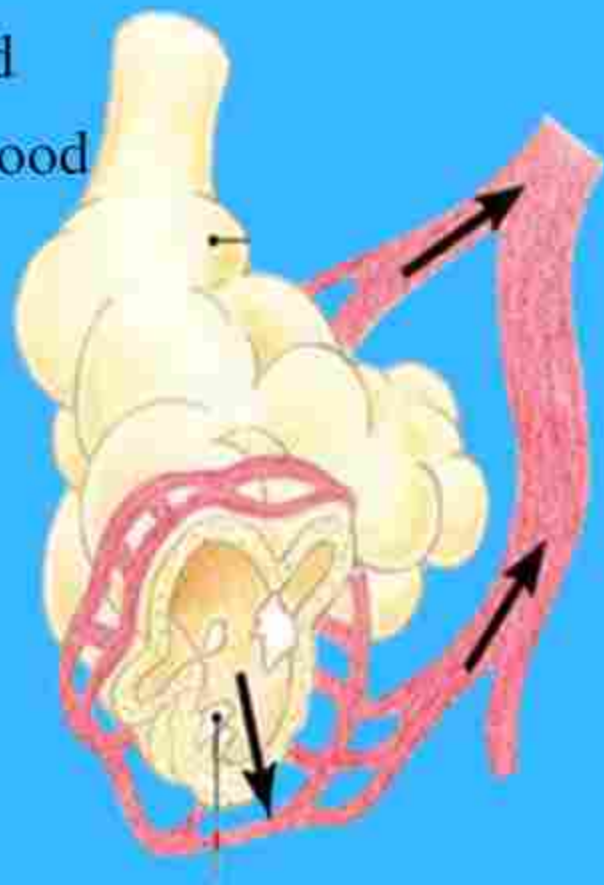
- Fresh water/Brackish water drowning
- Salt water/Sea water drowning



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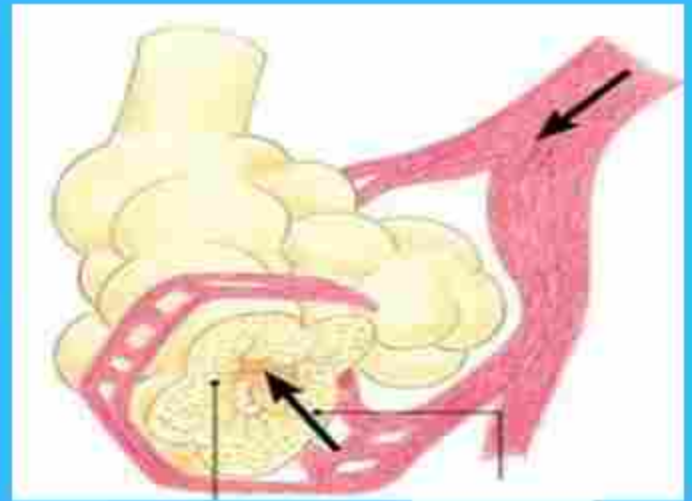
# Fresh water drowning

- Fresh water is more hypotonic than blood
- Water is passed from the alveoli to the blood
- Dry/Emphysematous lungs
- Hypervolemia/Hemodilution
  - Hyponatremia
  - RBC rupture → Hyperkalemia
- **Ventricular fibrillation**
- Denaturation of surfactant
- Fatal period → 4-5 min

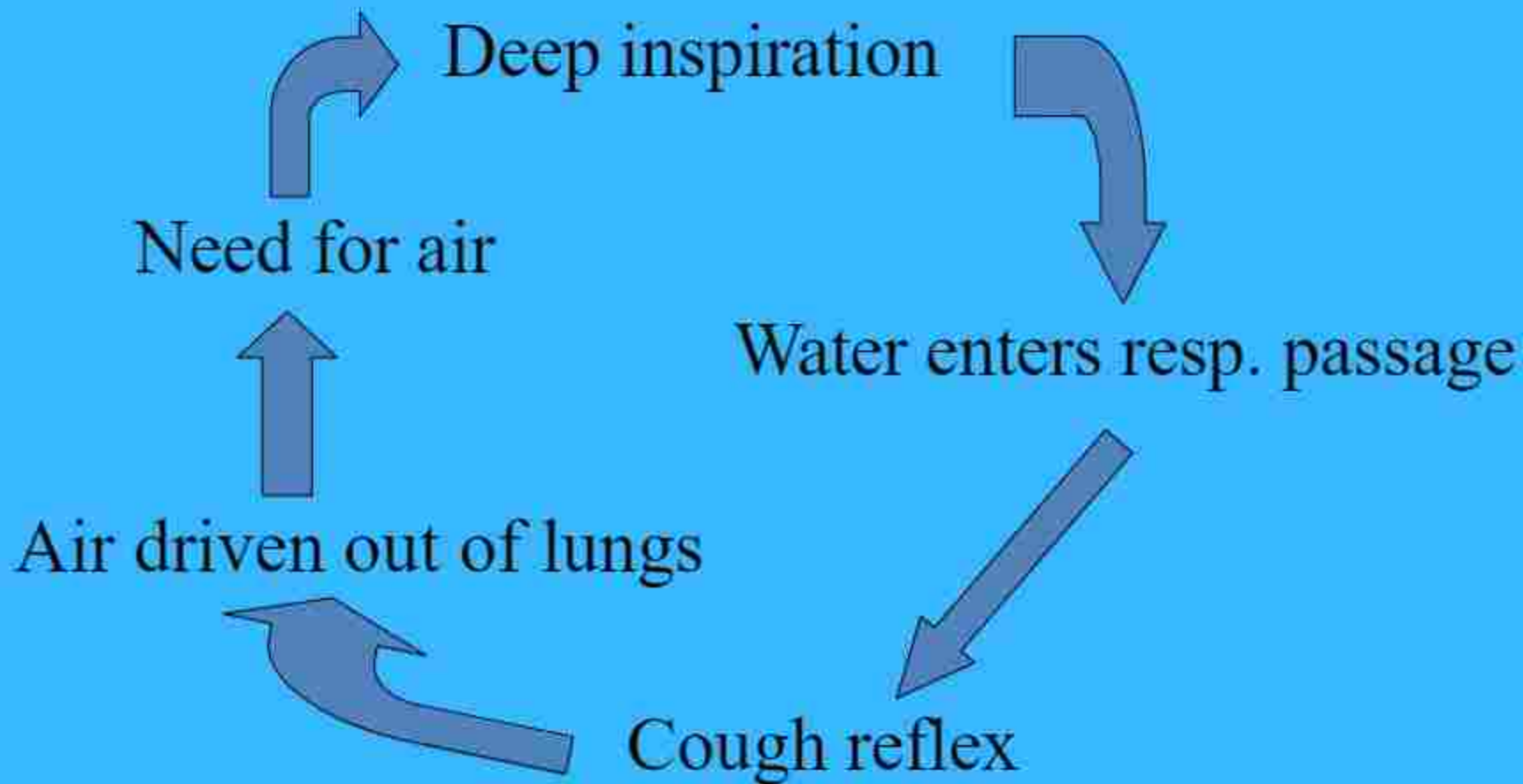


# Salt water drowning

- Salt water is more hypertonic than blood  
Water is drawn from blood to alveoli
- Wet / Edematous lungs
- Hypovolemia / Hemoconcentration
  - Hyponatremia
  - Crenation of RBC
- Asystole
- Dilution of surfactant
- Fatal Period → 8-12 min



# Vicious cycle of drowning





# Manner of death

## Accidental

- Water workers → Fishermen/Ship crew/Divers
- Children in bathtub/ponds
- While swimming → Epileptics/Heart diseases

## Suicidal

- Common in Southeast Asia

## Homicidal

- Rare
- Can occur if the victim is a child



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# External PM Findings

- No finding is specific to drowning
- Drowning is a diagnosis of exclusion
- **Rigor Mortis**
  - Comes and goes early if there is a violent struggle for breathing
- Cadaveric Spasm
  - Over hands
  - Grasping river weeds/sand/mud in a violent attempt to get out of water
  - Most convincing sign of AM drowning



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Pinkish lividity over face/anterior neck/ upper parts of chest / upper and lower limbs

- Pinkish d/t exposure to cold
- Body floats with face down/buttock up a position with both limbs and head submerged/hanging down

### As decomposition sets in

- The lividity turns purple/blackish turning the whole head/face/neck darker
- Face may be swollen with protruding eyes and tongue along with petechial haemorrhages
- **Tete De Negre's** appearance



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## Signs of immersion

Body and clothes wet

Sand/mud particles/river weeds/river insects over body & clothes

## Washer woman's hand and feet

- Wrinkled/Sodden/Bleached skin of hand and feet prominent over Palmar / Plantar aspect

## Cutis anserine/Goose skin appearance

- Erection of hair with the granular appearance of the skin of extremities



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Washer woman's feet Imbibition of water into epidermis



Cutis Anserina Cold contraction of Erector pilorii muscles



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# Froth from mouth and nostrils

- Fine & Lathery as 'Shaving lather'
- Tenacious or copious
- Reappearing after being wiped off, if pressure is applied over the chest
- Difficult to collapse by poking

D/t churning effect of **mucus/surfactant/drowning fluid/air** during violent respiratory effort

**Considered a vital phenomenon during drowning**

Other froth-producing conditions

Epileptic fits/Pulmonary oedema/Opium poisoning/Electrocution/Decomposition



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# Froth from nose



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# Other external findings

Injuries from marine animals feeding on the corpse

- Fish/ Crabs / other crustaceans

Injuries d/t flow of body with water current or during a struggle while inside water against rocks/vegetations/irregularities

- Back of hands/feet
- Bony prominences
- Extensors of legs/feet/knee
- Retracted genitals due to cold

If the body is rolled over by the flow of the river injury can occur anywhere



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Injuries by marine predators



Injuries d/t flow along with water



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# Internal PM findings

## Lungs

- **Edema aquosum** → Heavy / Water lodged **Emphysema a quorum** → Doughy / Ballooned
- Subpleural, ill-defined hemorrhagic areas mostly over margins/fissures / anterior surface **Paltauf's Hemorrhage**
- Rib indentation marks on pleural surfaces

## Tracheobronchial tree

- Froth and oedema fluid
- Mud / Sand / Aquatic vegetations **Presence in larger airways is not significant**

HYDROSTATIC LUNGS???



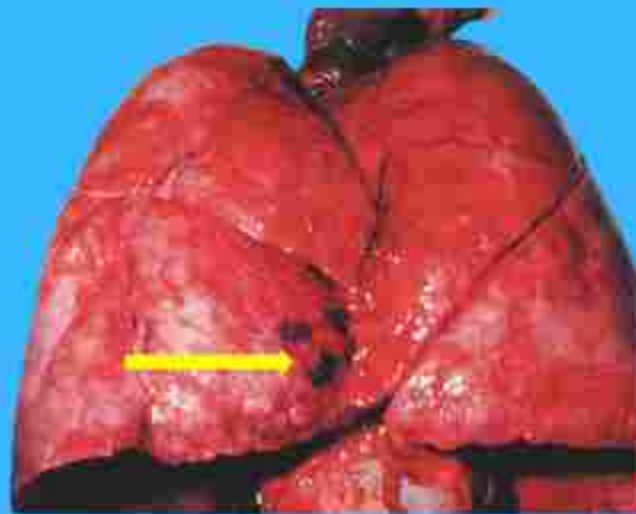
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Emphysema Aquosum Ballooning of lungs



Froth from cut surface of lungs



Emphysema Aquosum with Paltauf's Hemorrhage



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# Lungs in drowning

Trait	Fresh water drowning	Sea water drowning
Size and weight	Ballooned but light	Ballooned and heavy; weight upt 2 Kg
Color	Pale pink	Purplish or bluish
Consistency	Emphysematous	Soft and jelly like
Shape after removal from the body	Retained but do not collapse	Not retained; tend to flatten out
Sectioning	Crepitus is heard. Little froth and no fluid	No crepitus, Copius fluid and froth





# Other internal findings

## Mud / Sand / Vegetations

- In stomach → D/t swallowing / Passive entry
- In small intestine → Only d/t swallowing
- Water in the middle ear and Para-nasal sinuses
- Hemorrhage in middle ear/mastoid air cells/petrous temporal bone
- Difference in constitution/volume of blood
- Variation of electrolyte concentration at two sides of the heart
- Congestion of various organs



# Tests to narrow the diagnosis

## Gettler test

- Variation in **Chloride** concentration between two sides of the heart
- Freshwater drowning → Right > Left
- Saltwater drowning → Left > Right
- **Difference in the concentration** of at least **25 mg/dl** is considered significant

## Plasma magnesium

- **↑ on left side** d/t absorption from drowning medium usually **saltwater**
- **Serum strontium**



## **Diatom**

- Unicellular microscopic algae with siliceous frustule → resistant to extreme conditions
- Ubiquitous and abundant in water

A person alive during drowning → Water reach lungs → Diatoms present in water enter circulation through alveoli → Diatoms deposited in various organs

- Demonstration of diatoms in organ samples is considered proof of AM drowning

Bone marrow / Spleen / Kidneys / Brain / Lungs

## **Negative diatom test**

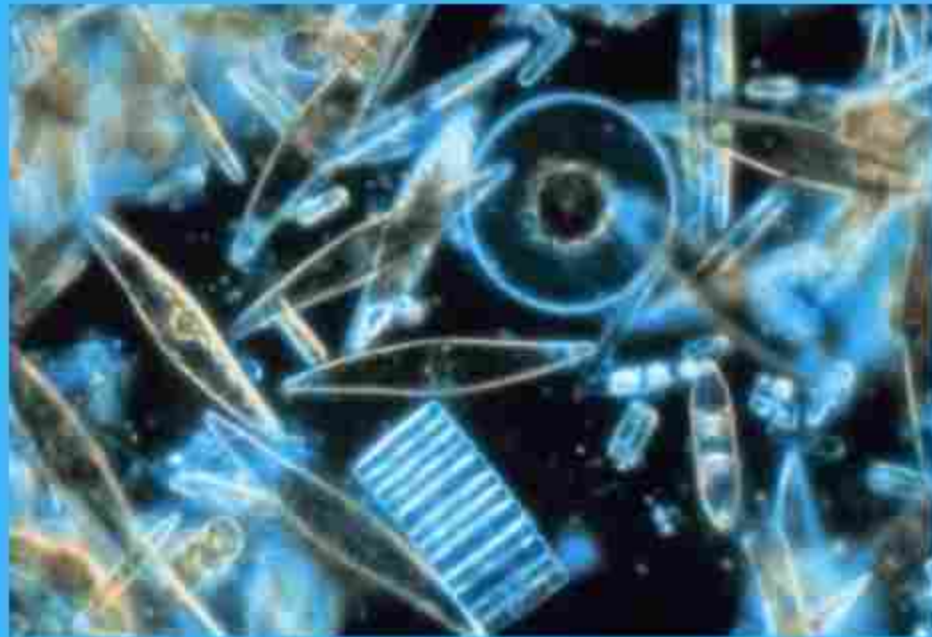
- Post-mortem disposal of a body in water
- Atypical drowning death



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# Diatoms



Dark Ground Illumination Microscopy



Scanning Electron Microscopy



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## **Diatom Test (Cannot be completely relied upon)**

Diatoms can enter circulation via the GI tract

- If a person has been drinking water from the same river/pond in which he drowned then he may already have diatoms in his organs
- Diatoms are ubiquitous so may gain entry into body prior to drowning through the lungs or GIT
- Most of us probably have some diatoms in our organs
- Even if the species of organ sample and the sample from drowning medium match, the test can be suggestive at most, but never confirmatory



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# Hyperventilation death

- Usually occurs in divers
- Caused d/t long and deep breaths before entering water
- Hyperventilation washes out  $\text{CO}_2$  from lungs
- Minimum  $\text{CO}_2$  required to stimulate the respiratory center is absent
- Hence apnea occurs inside the water
- Person becomes unconscious
- Dies of drowning



# Sexual Asphyxia

## Autoerotic asphyxia / Asphyxiophilia

- A type of sexual perversion
- Sexual gratification is achieved/enhanced by inducing controlled asphyxia by own self
- Masturbation/Fondling etc. are carried out along with any method of asphyxiation
- Controlled neck pressure/Gagging/Plastic bag suffocation/glue stiffening
- **Death is accidental**
- **Crime scene is a closed space containing pornographic materials/nudity of the body/bondage of genitals etc.**



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Sexual nature of the incident is quite obvious from the scene of death



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