Asphyxial deaths
DEATH BY ASPHYXIA

ASPHYXIA = ‘absence of pulsation’
‘Lack of oxygen’
Effective Respiration

depends upon a combination of three critical elements:

1. an open and patent airway
2. a functional muscular pump
3. an adequate gas exchange
Asphyxial deaths

Violent deaths initiated by interference with respiration
Rapid hypoxic / anoxic deaths

**Causes**

1. **Hypoxic hypoxia**— defective or total failure of oxygenation

   a. **Breathing in vitiated atmosphere:**
      
      i. by displacement of $O_2$ by inert gas fumes in wells and vats
      ii. By exposure to gases in atmosphere – sewer gas

   b. **Mechanical interference:**
      
      i. closure of external respiratory passages – smothering and overlaying
      ii. Obstruction of air passages – drowning, choking, throttling, strangulation, hanging

   c. **Interference with respiratory movements:**
      traumatic asphyxia
   d. **Paralysis Of Respiratory Center:**
      electrocution, some acute poisonings
2. **Anemic hypoxia** – reduced $O_2$ carrying capacity of blood
   acute CO poisoning, acute massive hemorrhage

3. **Stagnant hypoxia** – impaired circulation $O_2$ delivery per unit time
   shock

4. **Histotoxic hypoxia / anoxia** – depression of oxidative processes in tissues
   acute cyanide poisoning
Sequence of events that may seen in asphyxial episode

- **Dyspnoea phase**
  - Expiratory dyspnoea with raised respiratory phase, cyanosis and tachycardia

- **Convulsive phase**
  - Loss of consciousness, reduced respiratory movement, facial congestion, bradycardia, hypertension and fits

- **Pre-terminal respiratory phase**
  - No respiratory action, failure of respiratory and circulatory centers

- **Gaspering for breath**
  - Respiratory reflexes

- **Terminal**
Post-mortem Findings

General non-specific pathologic changes
due to
increased Capillary permeability
Endothelial fragility (hypoxia/anoxia)

Specific asphyxial changes
due to
Unique mechanism of asphyxial death
PETECHIAL HEMORRAGES
(Tardieu’s Spot)

Pinpoint (1 – 2 mm) collections of blood in serosal & skin surfaces due to rupture of small venules under pressure.

**Externally** Most often seen on face and conjunctivae
Bleeding from nasal mucosa and the external auditory meatus.

**Internally**
Most often seen on serous membranes of thorax. Mostly on visceral pleurae, and rarely on parietal pleura.

**Commonly seen on**
heart surface
Thymus in infants

**Never seen on peritoneal serosa.**
Significance of petechial hemorrhages
Signs of asphyxia

1 Petechial hemorrhages
2 Visceral congestion
3 Cyanosis
4 Cardiac dilatation
5 Fluidity of blood
Death due to pressure on Neck

1. Strangulation
   a. Strangulation by hands (called Throttling or Manual Strangulation)
   b. Strangulation by ligature

2. Hanging
   a. Complete hanging
   b. Partial hanging

*Mugging
- Carotid sinus reflex leading to cardiac arrest
- Jugular venous compression leading to cyanosis and petechie
- Carotid artery compression leading to unconsciousness
HANGING

is a form of asphyxiation as a result of suspension of the body by a ligature around the neck

The constricting force being the weight of the body

★ Complete hanging
★ Partial hanging
• Mechanism of death
Causes of death in hanging

- Cerebral ischemia
- Cerebral congestion
- Blockage of air passage
- Vagal inhibition
- Injury to spinal cord
Fatal period
Positions of ligature

- (a) Usual position with fixed noose and high suspension point. The mark rises high to a gap.
- (b) If a slipknot is used, the tightness of the deeply impressed loop tends to find the smallest circumference on the neck, and may be lower and more horizontal.
- (c) If the suspension point is low and the subject leans away, the mark can be horizontal.
Autopsy findings
External
Ligature mark
Ligature mark in hanging

In fixed noose ligature
In running or slip-noose ligature
Internal findings
Ante mortem hanging
Hanging

Manner of death
Judicial hanging
• Lynching
• Accidental hanging
  – Infants
  – Children
  – Adolescent
    • Autoerotic hanging
STRANGULATION

is the constriction of neck by means other than the weight of the body itself.

A ligature is usually used.
Methods other than ligature

• Mugging
  – Compress victim neck against arm

• Garroting
  – Attack from back without warning

• Bansdola
  – Neck is compressed between two hard objects or sticks
External appearance

- Vagal inhibition
- Slight vagal effect and some venous constriction
- Moderate venous constriction and some respiratory obstruction
- Pronounced venous and respiratory obstruction

- Instant death
- Slight asphyxial signs
- Moderate asphyxial sign
- Well marked asphyxial signs
Ligature mark in Strangulation is horizontal, completely encircles the neck, and is situated below, or at the level of thyroid cartilage. Knot may be anywhere

Bruising of underlying skin.

Injuries to deeper neck tissues are common.
Internal appearance
• Manner of death
  • Suicidal
    – Uncommon
  • Homicidal
    – Infanticide by strangulation
  • Accidental
    – New born
    – Child restrained by harness
    – Scarf and necktie in machinery
Difference between hanging and strangulation
Throttling
Manual strangulation

Mechanism of death
- pressure on neck → constriction of larynx: hypoxic hypoxia
- pressure on carotid sinuses → reflex cardiac inhibition through vagal stimulation
- obstruction of carotid art / jugular veins → cerebral hypoxia
Throttling
Manual strangulation

Autopsy findings

- non-specific general pathologic changes

Injuries on face and chest

tongue may be bruised
  bitten by teeth and protruding

face and eyes may show petechial hemorrhages

Body temperature may be raised
Injuries on the neck

Depends upon relative position of the victim and assailant, manner of grasping of neck and amount of pressure

When only one hand is used
When two hands are used
Throttling
Manual strangulation

Internal appearance
Asphyxial deaths

Throttling
Manual strangulation

Whether the death was due to throttling
Throttling
Manual strangulation

Manner of death
  homicidal
  accidental
• The garrotte was used for judicial execution in Spanish jurisdictions, in the form of a metal band encircling the neck.
• The collar could either be drawn backward suddenly by a long counter weighted lever or tightened by quick-threaded screw and flywheel.
• The Catalan garrotte was supplemented by a spike entering the back of the neck, simultaneously severing the spinal cord at the spinomedullary junction.
• Death from spinal dislocation and high-level cord destruction was supposedly instantaneous, ensuring a similar bloodless outcome to modern judicial hanging.
Suffocation
smothering & overlaying

Manner of death
accidental mechanical suffocation
suicidal
homicidal

Mechanism of death
hypoxic hypoxia       anoxic anoxia

Autopsy findings
non-specific general pathologic changes
specific findings
PM lividity
external wounds over face
Traumatic asphyxia
“Restraint Asphyxia.”

Mugging
Arm-lock
Mechanical Restraint of agitated and violent patients and transporting patients in ambulances
Positional Asphyxia
occurs when the position of a person’s body interferes with respiration, resulting in death from asphyxia or suffocation.

At death, the victim must be found in a position that interferes with pulmonary gas exchange (breathing). Such a position may range from one that causes obstruction of the mouth and nares, to one that causes restriction of the chest or diaphragm.

The inability of the victim to escape this position must be explained. In positional asphyxia deaths unrelated to restraints, unconsciousness due to acute alcohol intoxication is the most frequent explanation of the victim’s inability to escape from the asphyxiating position.

All other causes of death – natural or unnatural, medical or traumatic – must be explored by autopsy and excluded to a reasonable degree of medical certainty.
Hobble Restraint
also been called “hog-tying.” frequently employed by police officers for control of significantly combative parties
Drowning
Drowning

• Who is the person
• How long has the person been in the water
• Did the person drown
• Why did the person drown
• died from natural disease before falling into the water
• died from natural disease while already in the water
• died from injury before being thrown into the water
• died from injury while in the water
• died from effects of immersion other than drowning
• died from drowning.
• All the above may show signs of immersion on examination
• **Typical drowning**
  – Wet drowning
    • Fresh water
    • Salt water

• **Atypical drowning**
  – Dry drowning
  – Immersion syndrome
  – Submersion of the unconscious
  – Near drowning /secondary drowning
Various events of mechanism of drowning
• Stage of surprise
  • Last for 5-10 sec

• First stage of respiratory arrest
  • Last for 1 min and involve struggle to reach at surface

• Stage of deep respiration
  • Last for 1 min coupled with formation of froth /foam

• Second stage of respiratory arrest
  • Last for 1 min sensibility was lost and hypoxic convulsions occur

• Terminal gasping
  • Last external signs of death

  • It take 3-4 minutes
Mechanism of froth formation
Death due to natural disease

• Cause before entering the water
  – Well establish pathology

• Natural death whilst in water
  – Pre existing condition may be exacerbated by physical exertion
  – Splanchnic shunt after heavy meal
How long has the person been in the water

- Cooling of the body
- Rigor mortis
- Hypostasis
- Decomposition
- Maceration of skin
- Formation of adipocere
Drowning / immersion

Specific pathologic findings
Drowning / immersion

Internal findings
Drowning / immersion

Physiochemical test

Diatoms test

unicellular algae.

Resist acid digestion, heat and putrefaction

Isolated by acid digestion of bone marrow, lung, blood, kidney

Centrifugation and washing

Examined by phase contrast microscopy

Chloride content

Diagnosis of cause of death by chloride estimation

Chloride content from left and right side of heart

Difference of 25 mg/100ml is significant

Salt water drowning produce opposite effect

Injuries on drowned bodies
Estimation of duration of immersion

- If no wrinkling of the finger pads is present
- Wrinkled fingers, palms and feet
- Early decomposition
- Bloating of face and abdomen with marbling of veins and peeling of epidermis on hands and feet and slippage of scalp
- Gross skin shedding

- Less than few hours
- ½ day -3 days
- 4-10 days
- 2-4 weeks
- 1-2 months
Asphyxial deaths

Drowning / immersion

Additional medico-legal points
injuries on drowned bodies
Drowning / immersion

Manner of death

Suicidal

Homicidal

Accidental
Paltauf's spots/hemorrhages
Marine predator injuries
circular defects caused by crustaceans