DEATH

- **Thanatology** → Science deals with study of death.
- **Death** can be defined as permanent and irreversible cessation of three interlinked vital systems of body namely – nervous , circulatory and respiratory system.
- **Under Sec 46 of I.P.C.:** Death represent the end of life of a human being unless there is any contradiction that appears from the context.
- **Under Registration of Births and Deaths Act, Sec. 2(b)** defines death as permanent disappearance of all evidence of life at any time after livebirth has taken place.

Types of Death:

(1) **Somatic Death** or clinical Death

(2) **Molecular Death** or cellular Death.

1. **SOMATIC DEATH:** It is the complete and irreversible stoppage of the –

   i. **circulation**

   ii. respiration

   iii. brain functions.

   → **Bishop's tripod of life.**

(Note- Bichat believed that life could be compared to a tripod, with the three legs representing brain, heart and lungs. If any leg perished, very soon (i.e. within minutes) all legs would perish, and the tripod of life would fall (death))

Organ transplantation:

- Cornea -within 6 hours
- Skin - 24 hours
- Bone - 48 hours
- Blood vessels - within 72 hours
- Kidneys, heart, lungs, pancreas and liver - soon after circulation has stopped.

TERMS:

(1) **Homologous donation** means grafting of the tissue from one part of the body to another in the same patient, such as skin or bone.

(2) **Xenograft** is grafting of animal tissue into humans, which has limited success.

BRAIN DEATH- It is of 3 types:

1. Cortical or cerebral death-

- Brain stem may be intact.
- Respiration continue.
- Loss of perception.
- Vegetative state

2. Brain stem death-

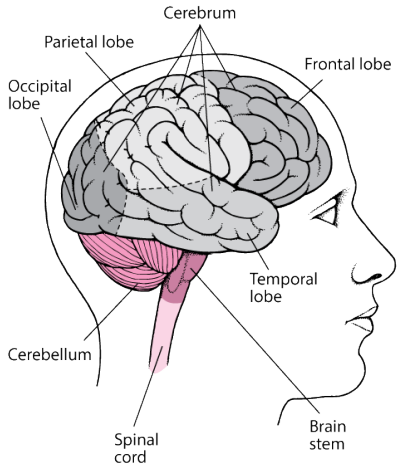
- cerebrum may be intact.
- Loss of spontaneous respiration.
- Loss of consciousness.
- coma

3. Whole brain death -

- Permanent cessation of functions of cerebrum, cerebellum and brain stem.

Brain stem –

- The brainstem is the structure that connects the cerebrum of the brain to the spinal cord and cerebellum.
- It is responsible for vital function of breathing, consciousness, blood pressure, heart rate and sleep.



2. **MOLECULAR DEATH :**

- ✓ It means the death of cells and tissues individually.
- ✓ It takes place usually one to two hours after the stoppage of the vital functions.(somatic death)
- ✓ Individual cells will live on their residual oxygen for a variable time after the circulation has stopped, depending on the metabolic activity of the cell.
- ✓ **Nervous tissues die rapidly, the vital centres of the brain in about five minutes, but the muscles live up to one to two hours.**

Natural Death:

- If death is caused by disease or dying of old age or natural process, the manner of death is natural.

Unnatural Death:

- If death is caused by injury or results from an external cause that includes homicides, suicides, accidents, medical errors, alcohol intoxications, poisoning, drug overdoses (intentional and unintentional) and drowning, the manner of death is unnatural or violent.

Cause of death	Mode of death (Mechanism of Death)	Manner of death
Disease or injury responsible for starting the sequence of events (brief/prolonged) producing death.	Abnormal physiological state at the time of death	The way in which cause of death was produced
Cause divided 1.Immediate cause 2. Basic cause 3. Contributory cause	No information regarding cause of death Agonal Period	Natural/ Unnatural Unnatural- Suicidal, Homicidal, Accidental, Undetermined/ Obscure

CAUSE OF DEATH:

The cause of death is the disease or injury responsible for starting the sequence of events, which are brief or prolonged and which produce death.

It may be divided into:

(1) IMMEDIATE CAUSE- The injury or disease present at the time of terminal event, e.g., bronchopneumonia, peritonitis, trauma, etc.

(2) BASIC CAUSE,(Proximate cause) - The pathological processes responsible for the death at the time of the terminal event or prior to or leading to the event, e.g., gunshot wound of abdomen complicated by generalised peritonitis.

(3) CONTRIBUTORY CAUSE - the pathological process involved in or complicating, but not causing the terminal event. In some cases, the basic and the immediate cause may be identical.

MANNER OF DEATH

- It indicates the circumstances under which the person died.
- For examples-Murder, suicidal, homicidal, accidental, etc.
- It is established from the personal and family history, circumstantial information from the scene of death, witnesses of the event, information from family members and others and by the autopsy findings.
- If death occurs exclusively from disease, the manner of death is natural.
- If death occurs exclusively by injury or is hastened due to injury in a person suffering from natural disease, the manner of death is unnatural or violent. Violence may be suicidal, homicidal, accidental or of undetermined or unexplained origin.

Modes of Death:-system that initiates the process of death.

These modes are:-Coma, Syncope and Asphyxia

(1) **Coma**- When death results primarily from the failures of the vital centres of the brain.(nervous system)

(2) **Syncope** - When death occurs primarily as a result of heart failure.(circulatory system)

(1) **Asphyxia-** When the respiratory function of lungs stops as a result of lack of oxygen, it causes failure of heart and brain as a result of oxygen deprivation.(respiratory system)

COMA:

- It is a state of unarousable unconsciousness determined by the absence of any psychologically understandable response to external stimuli or inner need.
- It involves the central portion of the brain stem.
- Coma is a clinical symptom and not a cause of death.

CAUSES:

(1) Compression of the brain, e.g., effusion of blood on or in the brain, inflammation, abscess or neoplasm of brain.

(2) Drugs; opium, hypnotics, cocaine, alcohol, anaesthetics, cyanide, atropine, phenol, oxalic acid, CO, etc.

(3) Metabolic disorders and infections: uraemia, cholaemia, eclampsia, diabetes, pneumonia, infectious fevers, heat stroke, etc.

(4) Other causes: embolism and thrombosis in the cerebral vessels, epilepsy, hysteria, etc.

AUTOPSY:

- Injuries or disease of the brain may be present as noted in the causes of coma.
- The lungs, brain and the meninges are congested.
- Splanchnic pooling of blood occurs.

SYNCOPE:

- Syncope is sudden stoppage of action of the heart, which may prove fatal.
- Syncope is caused by reflex bradycardia or asystole, or by reflex splanchnic vasodilation.
- Due to the acute reflex circulatory changes, blood pressure falls suddenly causing cerebral anaemia and rapid unconsciousness.
- Recovery is common.
- It is not used as a cause of death.

CAUSES:

(1) Anaemia due to sudden and excessive haemorrhage.

(2) Asthenia from deficient power of heart muscle as in fatty degeneration of the heart

(3) myocardial infarction

(4) certain poisons.

(5) Vagal inhibition.

(6) Exhausting diseases.

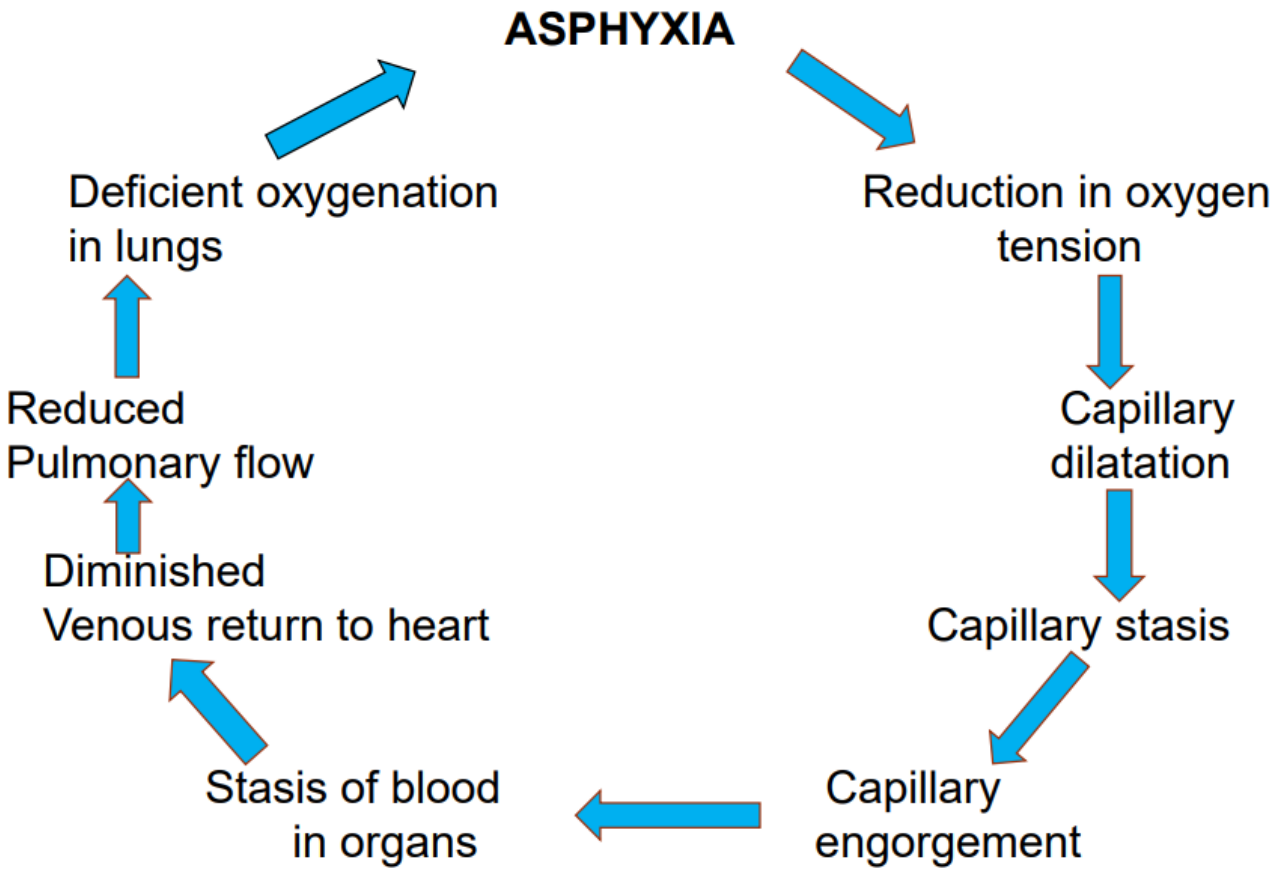
AUTOPSY:

- The heart is contracted and the chambers are empty when death has occurred from anaemia.
- The lungs, brain and abdominal organs are usually pale.
- Splanchnic pooling of blood occurs.

Asphyxia

- ✓ Asphyxia is a condition caused by interference with respiration, or due to lack of oxygen in respired air, due to which the organs and tissues are deprived of oxygen (together with failure to eliminate C02), causing unconsciousness or death.
- ✓ The term asphyxia indicates a mode of dying, rather than a cause of death.

Vicious cycle of asphyxia.



Cause of asphyxia

- When the neck is compressed, occlusion of jugular veins prevents venous drainage from the head, but the arterial supply continues through the carotid and vertebral arteries.
- When the air-passages are occluded, the impaired oxygenation in the lungs causes decrease in the oxygen content of arterial blood.
- Reduction in oxygen tension causes capillary dilation which is followed by stasis of blood in the dilated capillaries and venules, which produces capillo-venous engorgement.
- This blood stasis causes congestion of organs, and venous return to the heart is diminished leading to anoxia, which causes capillary dilatation and the vicious cycle goes on.

Types of asphyxia-

1. **Mechanical asphyxia**
2. **Pathological asphyxia**
3. **Toxic asphyxia**
4. **Environmental asphyxia**
5. **Traumatic asphyxia**
6. **Postural/Positional asphyxia**
7. **Iatrogenic**

Types of asphyxia

1. **Mechanical asphyxia**: In this the air-passages are blocked mechanically, such as-
   - Closure of the external respiratory orifices like nose and mouth with the hand or a cloth or by filling these openings with mud or other substance like in smothering.
   - Closure of the air passage by external pressure on the neck, as in hanging, strangulation, throttling, etc
   - Prevention of entry of air due to the air-passages being filled with fluid, as in drowning.
   - Closure of the air-passages by the impaction of foreign bodies in the larynx or pharynx as in choking.

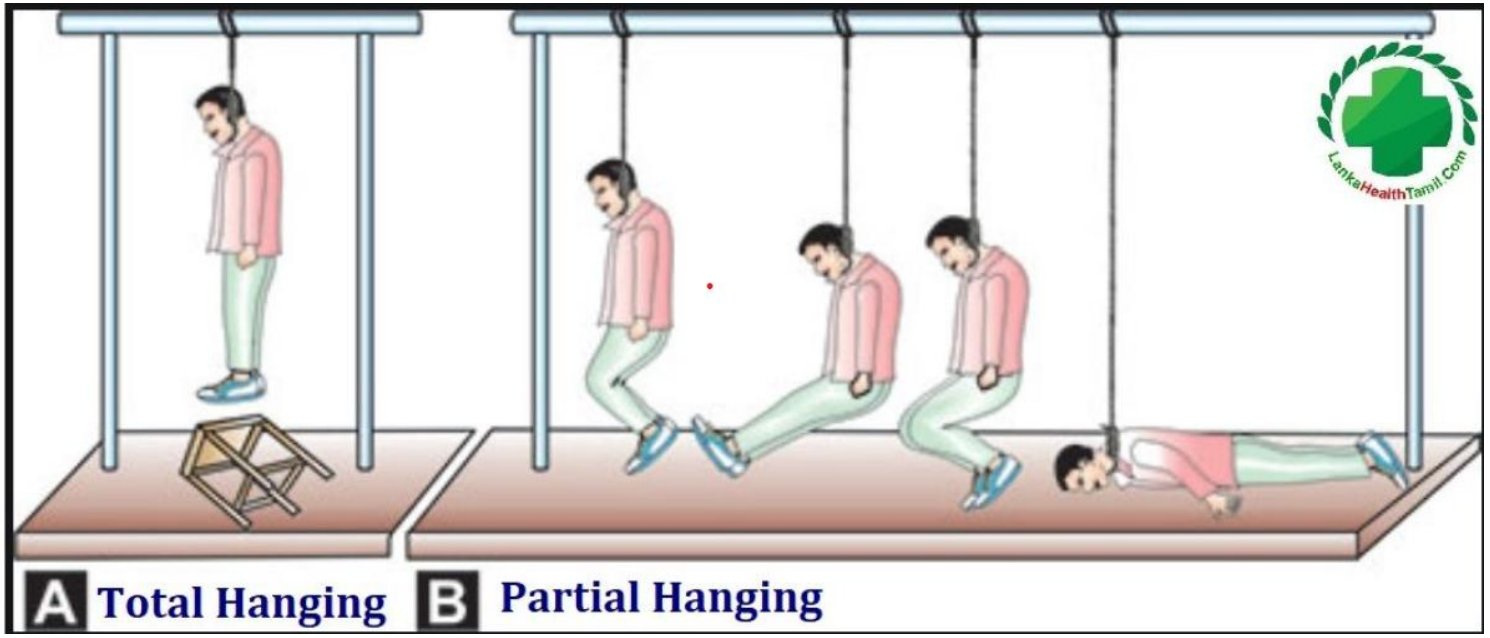
- Hanging (self-suspension)- is that form of asphyxia which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body.

Classification:

Depending on degree of suspension:

(a) Complete hanging: Body is completely suspended without any part of the body touching the ground.

(b) 'Partial hanging': the bodies is partially suspended, the toes or feet touching the ground, or is in a sitting, kneeling, lying down, prone or any other posture, with only the head and chest off the ground.


A Total Hanging
B Partial Hanging
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- **Strangulation** is that form of asphyxia which is caused from constriction of the neck by a ligature without suspending the body.
- Asphyxia produced by compression of the neck by human hands is called **throttling.**
- **MUGGING** : Strangulation is caused by holding the neck of the victim in the bend of the elbow.
- **SMOTHERING** : This is a form of asphyxia which is caused by closing the external respiratory orifices either by the hand or by other means, or blocking up the cavities of the nose and mouth by the introduction of a foreign substance, such as mud, paper, cloth, etc.
- **GAGGING:** This is a form of asphyxia which results from forcing a cloth into the mouth, or the closure of mouth and nose by a cloth or similar material, which is tied around the head.
- **Choking** is a form of asphyxia caused when an object lodges in the throat or windpipe blocking the flow of air.

2. Pathological asphyxia: In this, the entry of oxygen to the lungs is prevented by disease of the upper respiratory tract or of the lungs, e.g., bronchitis, acute oedema of the glottis, laryngeal spasm, tumours and abscess.

3.Toxic asphyxia: Poisonous substances prevent the use of oxygen.

(a) The capacity of haemoglobin to bind oxygen is reduced, e.g., poisoning by CO. Respiratory centre may be paralysed in poisoning by opium, barbiturates, strychnine, etc.

(b) The enzymatic processes, by which the oxygen in the blood is utilised by the tissues are blocked, e.g., cyanides.

(c) Respiratory centre may be paralysed in poisoning by opium, barbiturates, strychnine, etc.

(4) Environmental asphyxia:

(a) Insufficiency of oxygen in the inspired air, e.g., enclosed places, trapping in a disused refrigerator or trunk.

(b) Exposure to irrespirable gases in the atmosphere, e.g. sewer gas, CO, C02

(c) Exposure to high altitude.

(5) Traumatic asphyxia:

(a) Pulmonary thrmbo-embolism from femoral vein thombosis due to an injury to the lower limb.

(b) Pulmonary fat embolism from fracture of long bones.

(6) Iatrogenic- is mainly associated with anaesthesia.

(7) Postural/Positional asphyxia-

- Positional asphyxia is due to abnormal body position that prevents adequate gas exchange.

- In alcoholics or addicts, where the person is unconscious and the upper portion of the body is lower than rest, or neck is forcibly flexed on the chest which prevents normal respiratory movements. Deaths in such cases are diagnosed based on circumstantial evidence in combination with excluding other significant underlying causes of death.

Imp terms-

- **Tardie spot** also known as Petechial haemorrhages - These are small spots caused by the rupture of blood vessels under the influence of increased pressure from gravity and are most marked where for mechanical reasons, capillary congestion is most prominent. Tardieu spots are usually round, dark. and well-defined, varying in size from a pin's head to two mm.)
- Petechial haemorrage vary in size from 0.1 to 2 mm. If larger than this they are called **ecchymoses.**
- **Cyanosis** – A bluish discoloration of the skin and mucous membrane due to poor circulation and inadequate oxygenation of the blood.

(Write forensic significance and medicolegal aspect by giving examples)

- **Medicolegal aspects of asphyxial death –**

- involve the examination and interpretation of forensic evidence to determine the cause and circumstances surrounding a death due to lack of oxygen.
- This includes assessing signs of strangulation, suffocation, or other forms of asphyxia, and understanding legal implications for potential criminal investigations or legal proceedings.

Forensic significance-

- Asphyxial deaths occur when oxygen is significantly reduced or completely cut off, leading to a lack of oxygen in the body tissues.
- Forensically, determining the cause and manner of death in asphyxial cases is crucial.
- Autopsy findings, scene investigation, and toxicology analysis help establish whether the death resulted from hanging, strangulation, suffocation, or other forms of asphyxia.
- Understanding the forensic significance involves evaluating physical evidence, injury patterns, and circumstances surrounding the death to determine if it was accidental, suicidal, or homicidal.

(Note -This is for reference purpose only.)

Stages of rigor mortis

- **Primary relaxation-** soon after death, muscles of the body become relax.
- **Stiffening**- after some hours, muscles of the body become stiff and rigid.
- **Secondary relaxation-** In this, muscles stiffening disappear and again muscle become soft and flaccid.