Death & its causes I

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Thanatology

Science which deals with study of death

thanatos = "death"

logus = Science

Death is the end of dying

- It is a process rather than an event, except in certain cases like crushing of the brain in a vehicular accident, death in a nuclear explosion or in a bomb blast, etc where death is instantaneous
- **(Sec 2 (b) of Reg. of Births & Deaths Act)**

  Permanent disappearance of all evidence of life at any time after live birth has taken place.

- S. 46 IPC → Death means death of human being unless contrary appears from the context.

Types of Death

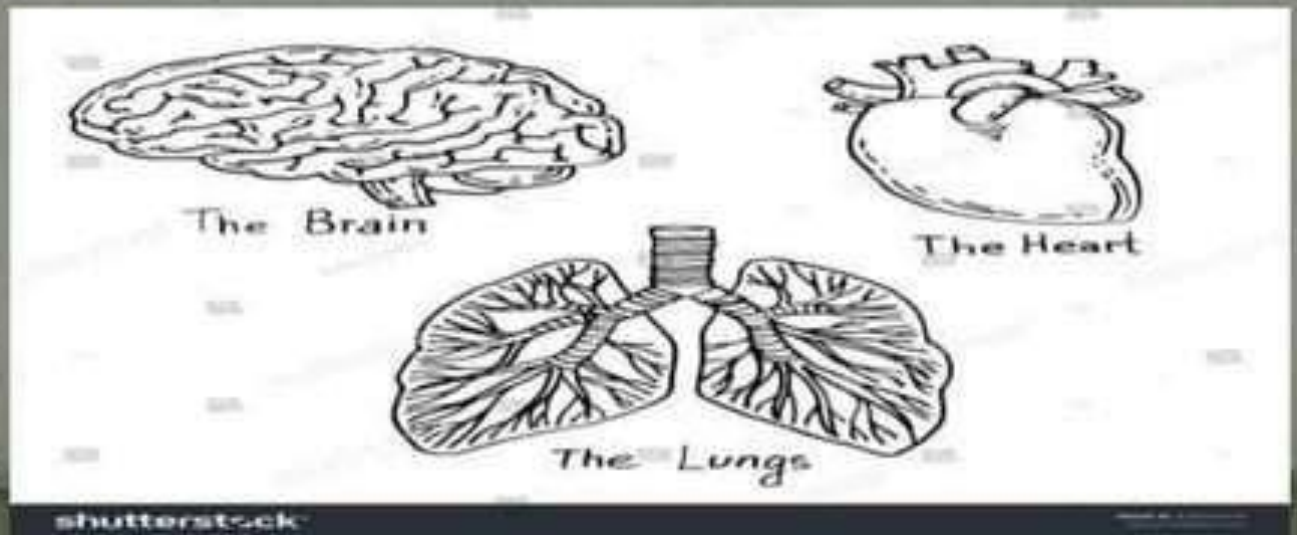
1. Somatic (or) Systemic (or) **Clinical.**
2. Molecular (or) Cellular.

SOMATIC DEATH: Complete and irreversible stoppage of

1. Circulation
2. Respiration
3. Brain functions

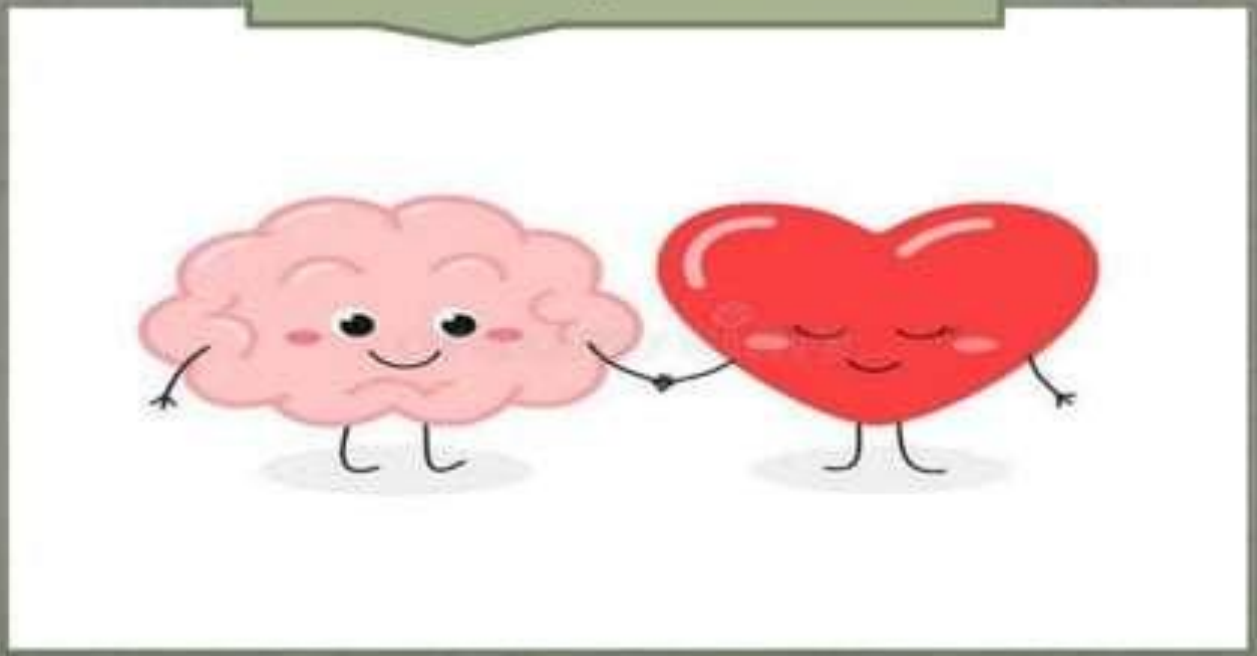
Bishop's tripod of life

- It is important in resuscitation & organ transplantation.
- Legally a person is dead after somatic death.



- Death is a process not an event
- Historically, *heart and respiration death*
- Heart lung bypass, mechanical respirators and other devices → brain death ????

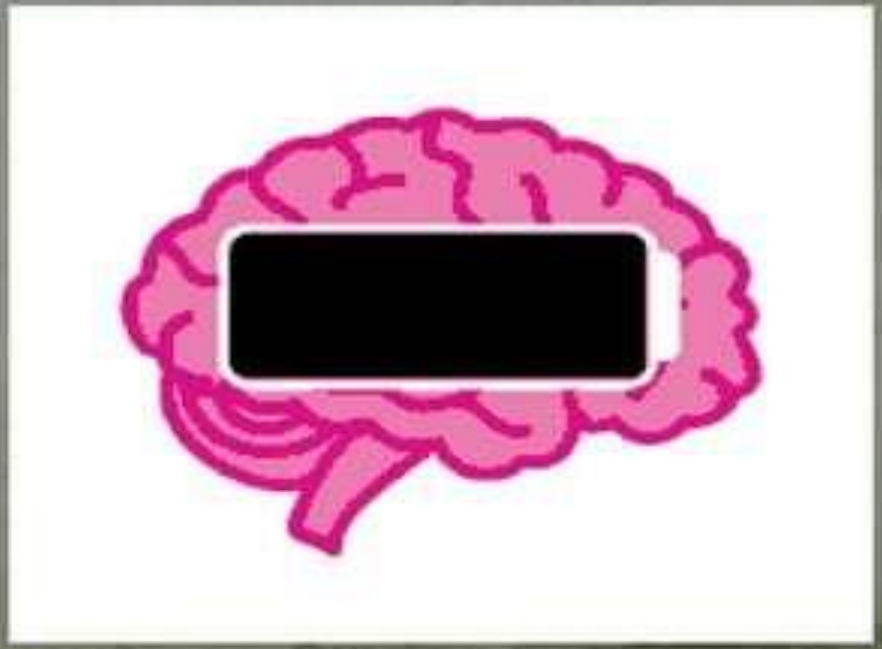
Come lets go sweetheart



Brain Death

Three types

1. Cortical or Cerebral death
2. Brain stem death
3. Whole brain death

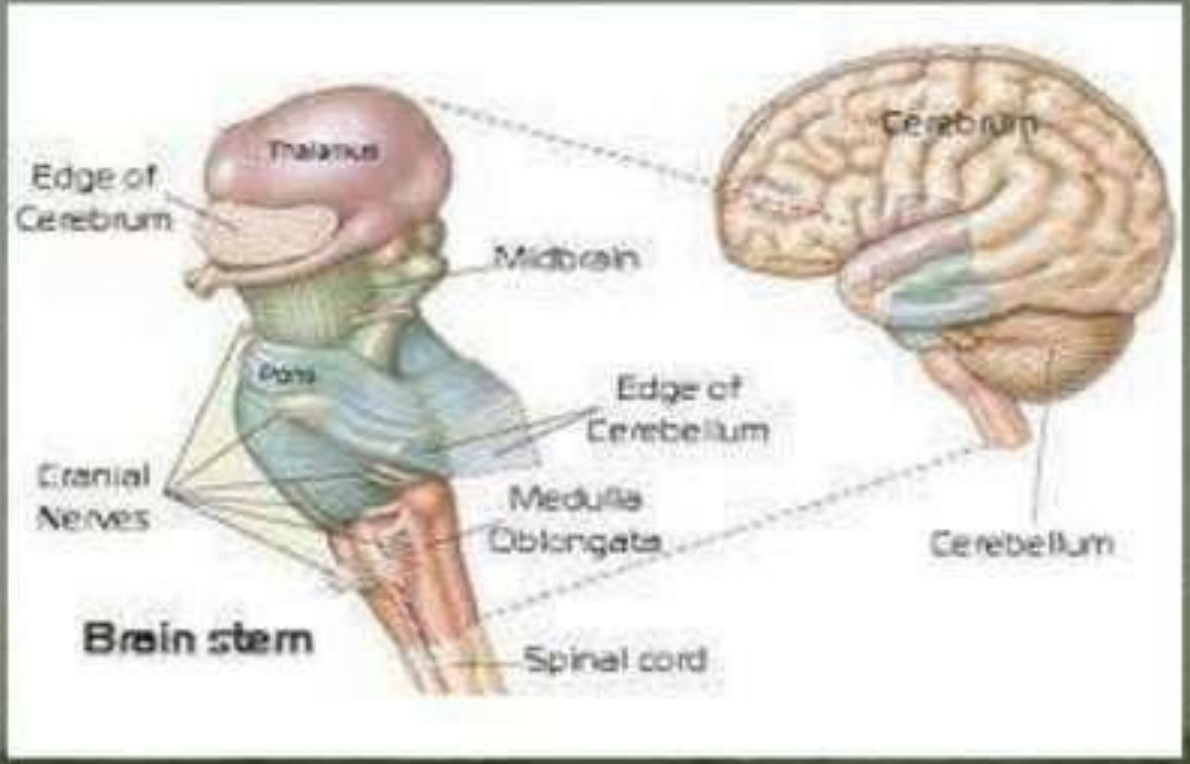


Cortical or Cerebral Death

- Intact brain stem
- Respiration continues
- Total loss of perception of all senses
- PVS → Persistent Vegetative state

Brain Stem Death

1. Intact Cerebrum
2. Loss of spontaneous respiration
3. Loss of consciousness
4. Coma



Whole Brain Death

Permanent cessation of functions of

1. Cerebrum
2. Cerebellum
3. Brain stem

- A person with brain stem death is considered as brain dead
- A person who cannot survive upon withdrawal of artificial maintenance is dead

Diagnosis of Brainstem Death

- **Exclusions**
  1. Under effect of drugs (Therapeutic drug/overdose)
  2. Core body temperature (< 35 °C)
  3. Severe metabolic or endocrine disturbance which may lead to severe but reversible coma
- **Preconditions**
  1. Deeply comatose
  2. On ventilator
  3. Known cause of coma

- **Personnel who should perform tests**
  a) Two medical practitioners.
  b) Expert in the field (not transplant surgeons).
  c) One should be consultant status (No JRs).
  d) Each should perform tests separately, twice.
- **Various criteria for Determining Brain death:**

i. Philadelphia Protocol (1969)

ii. Minnesota Criteria (1971)

iii. Harvard Criteria

Tests to be performed

- Core temperature > 35 °C
- Test function of cranial nerves passing through brainstem
- Three cardinal findings in brain death- (i) Coma (ii) Absences of brainstem reflexes (iii) Apnea
- If no response → brainstem death
  a) Pupils fixed and NR→ light
  b) No corneal reflex
  c) No vestibulo-ocular reflex
  d) No motor response to painful stimuli
  e) No gag reflex
  f) No respiratory movement on disconnection of ventilator even threshold conc. of CO_2 is reached in blood

2. Molecular death:

" death of cells and tissues individually"

- Takes place 2 hours after stoppage of vital functions

- Can be confirmed – electrical, thermal or chemical stimuli.

i. Nervous tissue - die rapidly

ii. Vital centers of brain about 5 minutes

iii. Muscles live up to 1-2 hours.

Survival of organs

- Cornea – 6 hours
- Skin – 24 hours
- Bone – 48 hours
- Blood vessels – 72 hours
- Kidney, heart, lungs, pancreas and liver must be obtained soon after circulation has stopped
- Cornea transplanted is not rejected

Features	Somatic death	Molecular Death
Definition	Complete & irreversible Stoppage of Circulation, respiration & Brain function	Death of individual tissues & cells
Onset	Precedes molecular death	Succeeds somatic death (1-2 hrs after stoppage of vital function
Response to External stimuli	Muscle responds to thermal, electrical or chemical stimulus	Does not respond
Confirmation	Flat ECG & EEG, absent of breath sound	Rigor mortis, algor mortis, PM lividity
Resemblance	Suspended animation, coma, hypothermia	Does not resemble any condition

Terminology

- **Ante-Mortem Injuries-** Injuries that occur during life
- **Post-mortem Injuries-** Injuries that occur after molecular death
- **Peri-mortem injuries-** Injuries caused between somatic death & molecular death
- **Agonal period-** Time between a lethal occurrence & death

(A) Cause of death	(B) Mode of death (Mechanism of Death)	(C) 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	Natural/ Unnatural Unnatural- Suicidal, Homicidal, Accidental, Undetermined/ Obscure

Agonal Period (Time between a lethal occurrence & death)

Manner of death

The way in which **cause of death** was produced

1. Natural
2. Unnatural
3. Obscure

1.Natural death:

Means that the death was caused **entirely by the disease**, and the trauma or poison did not play any part in bringing it about.

2.Unnatural death

1. Accidental injuries e.g. RTA
2. Homicidal injuries e.g. stab, lacerated, incised, firearm
3. Suicidal injuries e.g. firearm injury

Examples:-

A.

1. **Manner of death-** Homicide
2. **Cause of death-** Stabbing
3. **Mode/Mechanism of death-** Loss of blood/Syncope

B.

1. **Manner of death-** Homicide
2. **Cause of death-** Smothering
3. **Mode/Mechanism of death-** Asphyxia

- **Negative Autopsy**

"when gross and microscopical, toxicological analysis and laboratory investigations fail to reveal a cause of death, the autopsy is consider to be negative"

- 2-5% of all autopsies are negative.
- Due to:

1. Inadequate history. Ex. Death from vagal inhibition, status epilepticus, hypersensitivity reaction or laryngeal spasm etc.
2. Inadequate external examination. Ex – Needle mark, insect
3. Inadequate or improper internal examination
4. Insufficient laboratory examination
5. Lack of toxological analysis
6. Lack of training of doctor

- **Obscure Autopsy:**

In about 20% of all postmortem examination cases, the cause of death may not be clear at the time of dissection of the body and there are minimal or indeterminate findings or even no positive findings at all.

- The cause of death can be made out after detailed clinical & laboratory I/v & interview with persons

- **Causes are:**

i. Natural disease. Ex – little microscopic finding, fibrillation etc

ii. Biochemical disturbances. Ex- Uremia, diabetics, K deficiency etc

iii. Endocrine dysfunction. Ex- Adrenal insufficency, Thyrotoxicosis.

iv. Concealed trauma (v) Poisoning (vi) Miscellaneous

Sudden Death:(WHO)

"death is said to be sudden or unexpected when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness".

Incidence → 10% of all deaths

→ **Causes:**

(1) CVS → MI, CAD, Valvular, Atherosclerosis

(2) RS → Bronhcopneumonia, embolism, pneumothorax, impaction of foreign bodies

(3) CNS → Hemorrage, abscess, tumor, meningitis

(4) GIT → Varices, perforated ulcer, Intestinal obstruction

(5) GUT → Nephritis, tumors

(6) Misc. → DM, Reflex vagal inhibition, anaphylaxis

Reflex Vagal inhibition:

- Increased parasympathetic activity
- **Mechanism**: Skin, larynx, pharynx, pleura, peritoneum, spermatic cord, cervix, urethra having afferent pathway for reflex action of vagus nerve
- **Effect**: slowing of heart rate, acute bronchial spasm, sudden cardiac arrest

→Anaphylactic shock:

- **Aetiology**: Allergic reaction due to Drugs, Insect bites, Foods
- **Fatal Period**: 1-2 hrs
- **Mechanism**: Release of vasoactive endogenous substances causing laryngeal oedema, bronchospasm and vasodilation

MLI : Homicidal / Accidental

To access the relationship of disease with work, stress, trauma

Medico legal Importance of Death:

1. **Legal status of death→** Law takes notice of 3 things of dead body—
   (i) Decent burial
   (ii) Protection of reputation of deceased

2. Depending upon Cause, Mode and Manner of death decide further medico legal implication.

3. **Certification of Death**

4. **Body / Organ donation.**

Thank you