DEATH

THANATOLOGY

Science that deals with all aspects of Death

DEFINITION

- PERMANENT AND IRREVERSIBLE CESSATION OF LIFE
- CESSATION TO EXIST
- TOTAL STOPPAGE OF CIRCULATION OF BLOOD AND CESSATION OF VITAL FUNCTIONS SUCH AS PULSATION AND RESPIRATION

Death

- Clinical Death
  - Somatic death (soma=body)
- Molecular Death

CLINICAL DEATH

- To Declare a person dead
- Brain Death: Transplantation of organs

BRAIN DEATH

- Cortical death
  - Vegetative state or living cadaver
- Brain stem death: all functions of brain stem has irreversibly and permanently ceased
  - Incapable of spontaneous breathing
  - Without medical intervention cellular death will follow
  - In this physiological gap organs can be removed

CERTIFICATION OF BRAIN STEM DEATH

- Board of doctors consisting of:
  - RMP incharge of hospital
  - One independent specialist RMP from a panel of doctors authorized by appropriate authority
  - Neurologist or neurosurgeon FROM A PANEL
  - RMP treating the patient

PRECONDITIONS BEFORE CERTIFICATION

- Cause of irreversible brain stem death must be established
  - Trauma
  - Hypoxia
  - Toxic insult
  - Disease
- None of members of team declaring brain stem death should have interest in transplantation of organ

PRECONDITIONS BEFORE CERTIFICATION

- Must be examined twice at least with a reasonable gap (6hours)
- Reversible causes to be excluded
  - Intoxication
  - Depressant drugs
  - Muscle relaxants
  - Primary hypothermia
  - Hypo-volumic shock
  - Metabolic or endocrinal disorders

DIAGNOSIS

- Dilated fixed pupils not reacting to light
- No motor response from painful stimulus in area of cranial nerve distribution
- Corneal reflex absent
- Vestibulo-ocular reflex absent
- Gag reflex absent
- Spontaneous breathing absent

SUSPENDED ANIMATION

- Vital functions are such that it is difficult to detect them clinically though compatible with life.
  - Voluntary (Death trance)
  - In hypo-thermia
  - In new born infants
  - In electric shock
  - In bodies recovered from water
  - Vagal inhibitory reflex

Molecular Death

- Sure sign of Death
- Cremation and burial

Molecular Death

- Cells of body die
- Brain cells first to die within 5 minutes of stoppage of circulation
- Then lungs, liver (15 Min), kidneys (45Min) and heart (60 Min)
- Striped muscles for hours
- Hair and nails for days

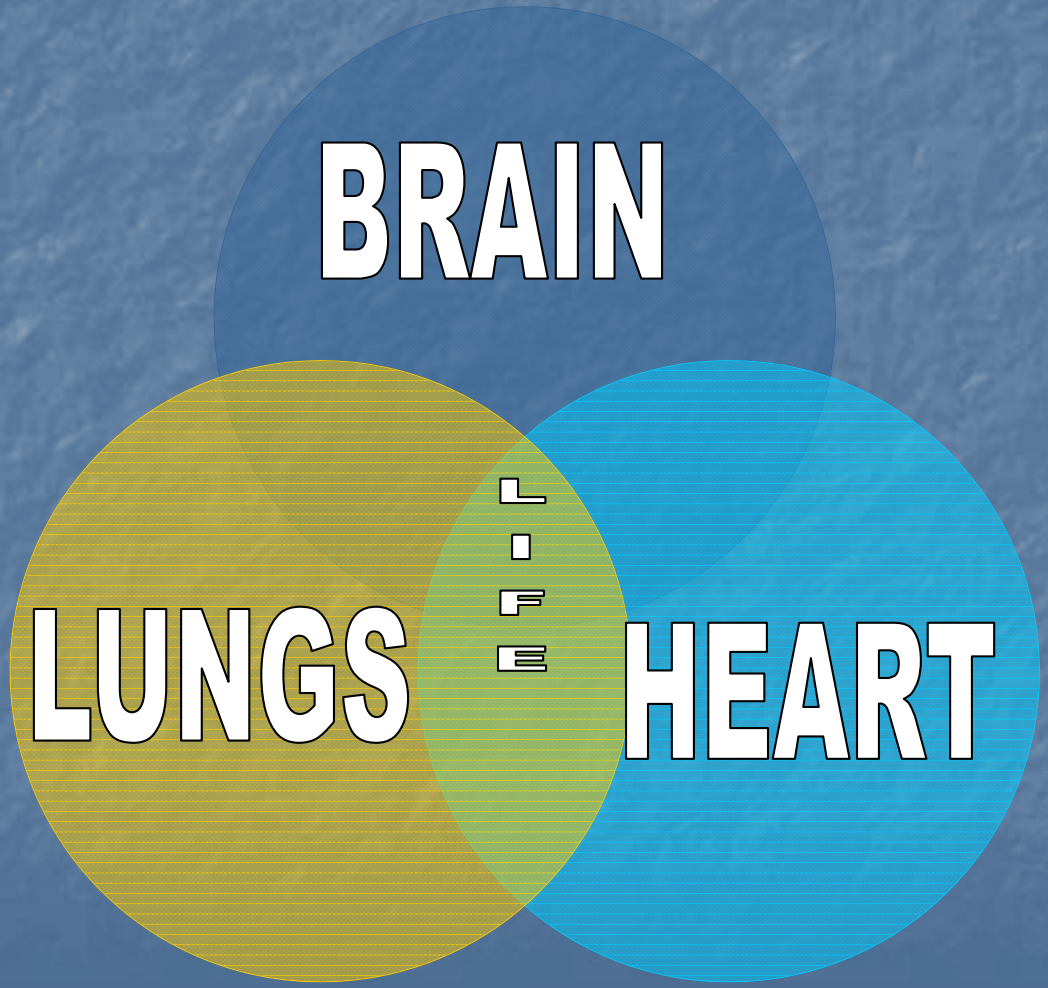
MODES OF DEATH

- Bichat's
  - Coma
  - Syncope
  - Asphyxia

  (Proximate Cause Of Death)
- Gordon's
  - Anoxic anoxia
  - Anemic anoxia
  - Stagnant anoxia
  - Histotoxic anoxia

  (Pathogenesis)

Tripod of life



Signs of Death

- Immediate signs of death
- Early signs of Death
- Late signs of Death

IMMEDIATE SIGNS OF DEATH

IMMEDIATE SIGNS OF DEATH

PERMANENT & IRREVERSIBLE CESSATION OF FUNCTIONS OF

BRAIN

HEART

LUNGS

Permanent stoppage of functions of Brain

- Flat EEG for 5 Minutes
- No movements
- No sensations

Permanent stoppage of functions of Heart

- No Heart Beat for 5 Minutes
- Flat ECG for 5 minutes
- Magnus ligature test
- Finger nail test..... etc

Permanent stoppage of functions of Lungs

- No Respiration for 5 minutes
- Mirror test
- Feather test
- Listening over trachea or chest with stethoscope

EARLY SIGNS OF DEATH

EARLY SIGNS OF DEATH

- Changes in the Skin
- Changes in the eyes
- Cooling of the body
- Postmortem staining
- Changes in the muscles

CHANGES IN SKIN

- Death pallor- face pale ashy white (blood drains out from smaller vessels)
- Loss of tone-wounds don’t gape
- Loss of translucency

CHANGES IN THE EYES

- Dilated pupils & loss of light reflex
- Loss of corneal reflex
- Hazy cornea
- Taches noires
- Fall of pressure in the eye balls
- Rail road phenomenon

PUPILS CONDITION

- Dilated pupils as iris muscles relax
- Loss of light reflex
- React to chemical stimulus in early hours

LOSS OF CORNEAL REFLEX

- Loss of corneal reflex
- Loss of conjuctival reflex
  - Narcotic poisoning
  - Epilepsy
  - General anaesthesia
  - Cautiously interpreted

HAZY CORNEA

- Dull and opaque
  - Appears in 2 hours
  - Dimmed in cholera, uremia, wasting diseases and narcotic poisoning
  - Preserve glistening in HCN and carbon monoxide poisoning

TACHES NOIRE

- Taches Noire De La Sclerotique
- In open eyes
- On exposed parts of sclera on each side of cornea
- Wedge shaped
- Due to cellular debris, mucus and dust
- Reddish brown in a few hours
- May become almost black

FALL OF PRESSURE IN THE EYE BALLS

- During life pressure is 14 -25 g
- Comes to half on stoppage of circulation
- 3 g after half an hour
- Nil after 2 hours
- By gentle palpation shape of pupil can be altered which is not possible during life

RETINAL CHANGES

- Blood in retinal vessels get segmented due ot loss of blood pressure (trucking)
- Within hour of death
- It is segmented everywhere but is possible to be seen in retina only
- In terminal stages can be there but there is movement like shunting, rail road phenomenon

ALGOR MORTIS

COOLING OF BODY

COOLING OF BODY

- One way to determine the postmortem interval
- Useful only in cold and temperate regions
- Normal temp is 98.4^0 F or 37^0 C, rectal temp is 99^0 F, Axillary temp is 97^0 F
- Life is not possible below 27^0 C
- Not useful in tropical countries when environment temperature is higher than the normal temperature of the body

COOLING OF BODY

- BY CONDUCTION
- BY CONVECTION
- BY RADIATION
- Core temperature is important
- Core temperature equals to that of environment
- Sigmoid shaped curve of cooling
- COOLS IN 16 – 20 HOURS
- By hand held computers and by nomograms

COOLING OF BODY

- Newton law of cooling
- Marshal and Hoare formula
  - If external temp is 60^0
  - Body uncovered
  - Limbs outstretched
  - Body built taken into consideration
  - For temperate regions
  - $1\text{-}2^0$ F/hour in different conditions

COOLING OF BODY

- In tropical countries not a good criterion
- 0.75^0 F per hour for tropical regions
- 1.5^0 F for temperate regions
- Approximate time= normal rectal temp – present rectal temp/rate of fall of temp per hour

RECORDING OF TEMPERATURE

- Chemical thermometer from 0 – 50^0 C
- Rectal temperature
- Inserted at least 10 cm into rectum
- Multiple reading at hourly interval
- Axilla, deep nasal passage, intra-abdiminal sub-hepatic
- Thermo-electric couple – computerized recorder

FACTORS AFFECTING COOLING

- Temperature of body at time of death
- Temperature difference between body and surroundings
- Clothings and coverings
- Body built
- Air currents and humidity
- postmortem caloricity

TEMPERATURE OF BODY AT TIME OF DEATH

- Raised
  - Asphyxial deaths, fat or air emboli, heat stroke, certain infections, drug reaction, cerebral hemorrhage, body near fire, in electric blanket or warm bath tub
- Lowered
  - Cholera, congestive cardiac failure, exposure to cold, massive hemorrhage,

TEMPERATURE DIFFERENCE BETWEEN BODY AND SURROUNDINGS

- Greater difference quick cooling
- In water heat lost by conduction and convection
- In burial only by conduction
- In air all three methods
- Bacterial flora or maggots may raise the temperature

CLOTHING AND COVERINGS

- Quilt or electric blanket left retards cooling
- Naked body early cooling
- Woolen clothing late cooling
- Wet clothing early cooling

BODY BUILT

- Surface area exposed to cooling
- Children and small stature early cooling
- Crouched position late cooling

- Thin persons cool rapidly
- Males cool rapidly as less fat

AIR CURRENTS AND HUMIDITY

- Still air retards cooling
- Free flow air rapid cooling
- Damp air early cooling

POSTMORTEM CALORICITY

- Rise of body temperature after death rather than cooling
- Postmortem glyco-genolysis- up to 2^0 C rise
- Asphyxial deaths
- Poisoning due to strychnine, dhatura and alcohol
- Drug reaction
- Heat stroke
- Brain stem hemorrhage
- Death due to nfections

POSTMORTEM STAINING
POSTMORTEM HYPOSTASIS
LIVOR MORTIS
POSTMORTEM LIVIDITY
SUGGILATIONS
VIBICES

Postmortem staining

- Collection of the blood in the toneless capillaries and veins in dependent parts of body due to action of gravity showing through the skin and giving a peculiar color.
- Imparts purple or reddish purple color

TIME OF APPEARANCE

- Starts in 1 - 3 hours as mottled patches
- At moment of death
  - Narcotic poisoning, circulation stagnant prior to death
- Delayed
  - Anemia, huge transfusion of saline,hemorrhage
- Patches increase in size and joins at periphery in 3 – 6 hours
- Throughout the area except pressure areas in 6 -12 hours

MOLE'S HYPOTHESIS

- Blood spontaneously coaguable when autopsy is carried within hour or so after death
- Spontaneous coaguability disappears after 1.5 hours of death
- Fibrinogen absent in blood which hs lost power of coaguability

MOLE'S HYPOTHESIS

- Fibrinolysin from postmortem blood acts only on fibrin and not on fibrinogen
  - Fibrinolysin is absorbed on to clotand on lysis of clot is released, not effective when added ot a clot already formed
  - Fibrinolysin produced by endothelial lining of vascular channels and body cavities

DISTRIBUTION

- Body lying on back
  - On posterior and dependent parts
  - Except areas of contact flattening
  - Not in areas compressed by tight clothing
- Body lying prone
  - On anterior parts

DISTRIBUTION

- Hanging
  - Lower limbs
  - Hands and distal parts of arms
  - Petechial hemorrhages
- Drowning
  - Face, upper part of chest, hands, lower arms, feet and lower legs as adomen lighter remains above in still water
  - In moving water may not develop

Fixation of lividity

- Relative term
- Inability of blood to flow in well developed areas as compared to first few hours
- Rigor mortis prevents flow of blood in bigger vessels
- Body might have been moved

COLOUR OF LIVIDITY

- Hypoxic states – darker colour
- Hypothermia, cold or drowning – pink
- CO or cyanide poisoning - Cherry pink
- Potassium chlorate – chocolate or coffee brown
- Phosphorus poisoning – dark brown
- Refrigerated body – bright pink

HYPOSTASIS AND BRUISING

- On dependent parts
- Well defined margins
- Uniform colour
- Not associated with abrasion
- No vital reaction
- Blood in vessels
- Blood can be washed with water

- Anywhere
- Margins merge
- Different color
- May be associated with abrasions
- Vital reaction
- Blood in tissue outside blood vessels
- Cannot be washed with water on cut section

IN INTERNAL ORGANS

- Posterior cerebral lobes
- Lower posterior surfaces of lungs and heart
- Posterior surface of liver, kidneys, spleen, stomach, dependent parts of jejunum and ileum,loops in pelvis most affected

STAINING V/S CONGESTION

- Dependent parts
- No swelling or oedema
- Oozing of blood from distended vessels on cut section
- Hollow viscous alternate stained and unstained areas

- All over or on a part
- Swelling and oedema present
- Exudation of blood mixed with fluid on cut section
- When stretched uniform staining

CHANGES IN LIVIDITY

- Dusky
- Brownish
- Greenish
- Greenish blue
- Greenish black
- Due to decomposition
- Formation of sulph- hemoglobin

Postmortem staining

- Post mortem interval
- Poisoning
- Posture
- Change of location
- Cause of death
- Manner of death- hanging