INTRODUCTION TO THANATOLOGY

By Dr. Nayella Nijat Bangash

THANATOLOGY

- thanatos----death
- Logos--------science

“The scientific study of the phenomena and practices relating to death.”

DEATH

It is defined as,**the cessation of life**.

Muller claims that, **dying is a process and not a moment of time**.

STAGES OF DEATH

Death occurs in two stages;

1) Somatic/systemic/clinical death
2) Cellular/molecular death

SOMATIC DEATH

It is due to complete and irreversible cessation of vital functions of the brain ,followed by cessation of vital functions of the heart and lungs.

CELLULAR DEATH

After somatic death,different tissues and cells survive for varying periods depending upon their oxygen requirement.When these individual tissues and cells die,it is termed as cellular or molecular death.

Tissue	Viability after death
Nervous tissue	4 to 5 minutes
Muscular tissue	6 hours
Cornea	6 hours
Skin	12 hours

So,nervous tissue dies rapidly,say within five minutes of cessation of oxygen supply to the brain.

BRAIN DEATH

Its of 3 types

- CORTICAL OR CEREBRAL DEATH
- BRAINSTEM DEATH
- WHOLE BRAIN DEATH

Brain Death

more appropriately known as

Brain Stem Death

Formely,cessation of heart beat and respiration were used as a criteria of death but now that cardiac transplantation is possible,emphasis has shifted to irreversible cessation of brain function.

It is now a certainty, that when brain death is accurately diagnosed, life will not return to the patient even with continuous cardiopulmonary support.

The effect of lack of/stoppage of oxygen on the CNS during the period of stoppage of respiration depends upon the degree of actual impact on the brain,whether the brain still functions and is capable of thought.

It is because of this that the role of brain and concept of irreversible brain damage in the form of brain death.

BRAIN STEM DEATH

- **Brain stem death** is a clinical syndrome defined by the **absence** of reflexes with pathways through the **brain stem** - the "stalk" of the brain, which connects the spinal cord to the mid-brain, cerebellum and cerebral hemispheres.

- Loss of **vital centres** that control respiration and of **ARAS** that retain consciousness ------> *victim is irreversibly comatose and incapable of spontaneous breathing (apnoeic).*

- i.e. brainstem death is when a person no longer has any activity in their brainstem, and has permanently lost the potential for consciousness and the capacity to breathe.

POSTMORTEM CHANGES

DEFINITION

Postmortem changes constitute the natural progression of the body's decomposition after death,beginning at the cellular level.

CLASSIFICATION OF POSTMORTEM CHANGES

1) **Immediate changes**
2) **Early changes**
3) **Late changes**

IMMEDIATE CHANGES

These constitute somatic or clinical death.

SIGNS OF SOMATIC/CLINICAL DEATH(IMMEDIATE CHANGES)

1) **Insensibility & loss of EEG Rhythm**
2) **Cessation of circulation & Loss of ECG Rhythm**
3) **Cessation of Respiration**

INSENSIBILITY & LOSS OF EEG RHYTHM

- Insensibility means loss of sensation(perception of touch,pain and temperature and loss of voluntary power to move)
- These are not conclusive signs of death as they are found in conditions such as fainting attacks,vagal inhibition,epilepsy,drowning,and electrocution,where some victims recover entirely

- They can be taken as conclusive only when associated with loss of EEG Rhythm for a continuous period of five minutes.

The most helpful aid in diagnosis of death is EEG.

CESSATION OF CIRCULATION

- The stethoscope is placed over the region of the heart apex(left fifth intercostal space)
- On auscultation,if the heart sounds are not heard for a continuous period of five minutes, it is acceptable evidence of death
- It may be difficult to hear the heart sounds if

1) **If they are feeble**
2) **If chest wall is thick**
3) **In emphysema**

- In case of doubt,an ECG will settle the issue
- It will record the electrical activity of the heart however feeble it may be

A flat ECG for a continuous period of five minutes is acceptable evidence of death.

CESSATION OF RESPIRATION

Respiration may cease for a very short period without death ensuing;

1) **As a purely voluntary act**
2) **In Cheyne-Stokes breathing**
3) **In the drowned**
4) **In the new-born infants**

- The stethoscope is applied to the upper part of the lungs in front or to the larynx itself where the faintest breath sounds can be heard

Complete absence of breath sounds for a continuous period of five minutes constitutes proof of death.

EARLY CHANGES

These follow within about 12-24 hours after death and denote molecular or cellular death.They include;

1) Cooling of the body
2) Changes in the eye
3) Changes in the skin
4) Postmortem Lividity
5) Changes in the muscles

LATE CHANGES

These follow after about 24 hours after death and represent decomposition or decay(putrefaction),or a modification of this process by adipocere formation and/mummification.

COOLING OF THE BODY

- ***Algor mortis***
  - Algor=coldness
  - Mortis=of death

- During life,there is a balance between heat production and heat loss
- After death,heat production stops,and the body loses heat by conduction,convection and radiation,till it is in equilibrium with the temperature of its surroundings
- This progressive fall in temperature is one of the most prominent early signs of death
- The amount of cooling indicates the time elapsed since death(provided environmental temperature is lower than body temperature.

RECORDING TEMPERATURE OF THE DEAD BODY

- The temperature of the dead body is recorded by a chemical thermometer(thanatometer),25cms long,with a range from 0-50 degrees Celcius,and graduated in subdivisions of single degrees
- It is inserted about 8-10cms in the rectum after ensuring that there is no local injury or homosexual activity,and swabs taken before insertion
- It is left there for two or three minutes

- In cases involving homosexual activity,the thermometer or thermocouple probe can be inserted in the auditory meatus or nostril as deeply as possible
- The temperature can also be recorded by making a small slit in the abdomen and inserting the thermocouple under the liver
- This wound must be recorded so as to not confuse it with antemortem injury
- The environmental temperature is also recorded and time noted
- Records are made at intervals to determine rate of fall of temperature.

ISO-THERMIC PHASE

When the body temperature is normal at the time of death,there is no fall in rectal temperature for about 45 minutes,this phase being known as the iso-thermic phase.

RATE OF COOLING

- It is not uniform but it is related to the difference in temperature between the body and its surroundings
- In the next two hours,the temperature falls at half this rate
- In the subsequent two hours at quarter this rate
- Thereafter,it falls much slowly till the body temperature is in equilibrium with the temperature of its surroundings.

CALCULATING TIME SINCE DEATH FROM ALGOR MORTIS

Time (in hours)since death=

$$\frac{\text{Normal body temperature} - \text{rectal temperature}}{\text{Average rate of fall of temperature per hour}(0.6)}$$

RATE OF LOSS OF HEAT(RATE OF COOLING)

Temperature of surface of object – temperature of surroundings

POSTMORTEM CALORICITY

The phenomenon of rise in temperature of the body within first two hours after death.

- There are certain conditions in which heat may be retained or even be increased in the first two hours after death.These include;

1) Sunstroke and pontine hemorrhage
2) Tetanus and strychnine poisoning
3) Acute bacterial or viral infections(lobar pneumonia,typhoid fever,encephalitis,encephalomyelitis)
4) Asphyxia

- After the initial rise of temperature,the body begins to cool as usual.

FACTORS AFFECTING RATE OF COOLING OF DEAD BODY

1) Age and condition of the body
2) Mode of death
3) Surroundings
4) Environmental temperature

AGE AND CONDITION OF BODY

- Children and adults of small stature cool rapidly due to large surface area compared to weight
- Lean bodies cool rapidly
- Fat bodied cool slowly(fat is bad conductor of heat)
- Bodies of women cool less rapidly than man as women are usually more fatty.

MODE OF DEATH

- In case of sudden death in healthy person,body cools slowly
- In case of sudden death after long wasting illness,body cools rapidly
- Body keeps warmer for long in deaths from asphyxia,lightning and carbon monoxide poisoning.

SURROUNDINGS

- Movement of atmospheric air accelerates cooling by convection.So body lying in well ventilated room cools faster
- Body cools quickly in water than on land by losing heat due to conduction.However,cooling is delayed if the temperature of water or atmospheric air is high
- Clothing is a bad conductor of heat so cooling occurs less rapidly in bodies covered in clothes,lying in bed,in a heap of dung,etc.

ENVIRONMENTAL TEMPERATURE

- The body cools rapidly when difference in environmental temperature and body is great.

CHANGES IN THE EYE

- **Changes in the Cornea;**
- The clear glistening appearance of the cornea is lost
- The cornea becomes dry,cloudy and opaque due to failure of production of tears
- The corneal reflex is lost but as it is also lost in cases of brain stem death,it is not a reliable sign
- The light reflex is also abolished

- **Fall in intraocular tension;**
- The intraocular tension falls
- The eyeballs become flaccid and tend to sink into the orbits;the flaccidity can be appreciated by palpation

- **Changes in the retina;**
- The blood stream in the retinal vessels rapidly becomes dotted first an then segmented(cattle trucking)
- The optic disc becomes pale

- **Changes in the pupils;**
- Pupils usually dilate at the time of death
- They constrict later on due to development of rigor mortis
- May be unequal

- **Changes in sclera;**
- **Taches noires** appear on sclera within three hours of death if the eyes remain open
  - These are areas of brownish-black discoloration,on exposed sclera between the eyelids,due to formation of cellular debris and dust settling thereon.

- **Biochemical changes;**
- The potassium content of vitreous humour rises steadily.

CHANGES IN THE SKIN

- The skin assumes a pale,ashy white appearance,more noticeable in fair skinned persons
- It loses elasticity so that postmortem incised wounds may not gape to same extent as antemortem wounds
- Lips tend to darken due to drying.

CLINICAL CRITERIA FOR CERTIFICATION OF DEATH

CRITERIA	SIGNIFICANCE
Bilateral fixed dilation of the pupils	Essential
Complete absence of reflexes both natural & unnatural	Essential
Complete absence of respiration	Essential
Falling b.p needing increasing amounts of vasoconstrictive drugs	Additional
Flat EEG for at least 6 hours	Additional

APPARENT DEATH

Synonym-----Suspended Animation

It is a condition in which the vital functions of the body(heart beat & respiration)are at such a low pitch(as in hibernating animals)that they cannot be detected by routine methods of clinical examination.

- The body for all intents and purposes looks and behaves like a corpse
- The person is not really dead
- This state may persist from a few seconds to several minutes after which a person can be revived while other may die
- Suspended animation mat occur in apparently drowned,in the new born,after anesthesia,in cerebral concussion,electrocution,heat stroke,mesmeric trance,in prolonged illness like typhoid fever,overdose by barbiturates or opiates,and in deep shock

- Humans have the ability to acquire such a state voluntarily and examples include the Saints & Sufis in Asia and the Yogi's
- The phenomenon also exists in animals during hibernation.

In such cases,a death certificate should not be issued without an EEG & ECG record,if necessary.

HUMAN TISSUE ACT

- the transplantation of human organs & tissue ordinance 2007
- the transplantation of human organs & tissue act 2010

They are meant to regulate the removal,storage & transplantation of human organs and tissues for therapeutic purposes and related procedural matters all over the country.

THE TRANSPLANTATION OF HUMAN ORGANS & TISSUE ACT 2010

- Donation by living person---A living donor not less than eighteen years,may during his lifetime,voluntarily donate any organ or tissue of his body to any other living person genetically and legally related,who is a close blood relative,for therapeutic purposes
- Donation after death---1)any person,not less than eighteen years,may before his death,in writing duly signed and verified by respective Evaluation Committee,donate any organ or tissue for transplantation & for this purpose may authorize any medical institution or hospital duly recognized by Monitoring Authority

2)unclaimed brain dead hospitalized patients shall be presented to an Evaluation Committee for transplantation after intense search for relatives within 24 hours.

- Evaluation Committee------shall consist of a surgical specialist,a medical specialist,a transplant specialist,a nephrologist,a neurophysician and two local notables having good record of social service.The Evaluation Committee shall(a)ensure that no organ is retrieved from non-related donors without the prior approval of the Committee;(b)determine brain death of a person;(c)determine fitness for transplantation of a human organ into any other body
- Transplantation------to be carried out by a team of transplant surgeons & physicians authorized for this purpose,who,before removal of any tissue or organ from the body of the deceased must ensure that written certification of death has been obtained from the Evaluation Committee.

- Punishment of those involved in commercial dealings of human tissues and organs.

MEDICOLEGAL IMPORTANCE OF DEATH DIAGNOSIS

1) Detect cause of death
2) Know time of death
3) Social reasons
4) Organ donation
5) Apparent death
6) Statistical reasons
7) Inheritance reasons

THE END.