BRAIN DEATH

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BRAIN DEATH

Its of 3 types

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

Brain Death

more appropriately known as

Brain Stem Death

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

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.

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.

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.

- Can be produced by
  - Raised intra cranial pressure
  - Cerebral edema
  - Intracranial hemorrhage etc.

LEGAL DEATH

When the properties of the whole patient are irreversibly lost following brain death,he should be taken as LEGALLY DEAD.

The cells and tissues remain viable for a variable time after systemic death.Since systemic death occurs earlier than death of the organs,there should be no objection to the preservation and removal of the properties of the living matter in the component parts for the purposes of organ transplantation.

A person whose brain may have been injured irreversibly can now be kept alive by maintaining circulation of oxygenated blood to the brain stem by artificial means.

Such a patient,after appropriate brain stem reflex testing,can now be declared LEGALLY DEAD,and organs required for transplantation can be removed even though circulation and respiration have not ceased due to artificial maintainance.

NECESSITY OF PRONOUNCEMENT OF LEGAL DEATH

- Disposal of the body;

Rarely,when the body is cremated soon after death,spontaneous movements of hands and feet may occur on the funeral pyre.This may give rise to doubt that the person was not actually dead but was prematurely disposed off.

- Transplantation;

The viability of transplantable organs falls sharply after somatic death(liver must be taken within 15 minutes,a kidney within 45 minutes, and a heart within an hour).

CERTIFICATION OF DEATH

The certification of death must be based on clinical judgement fulfilling certain essential criteria and not in the clinical interest of an individual in the preservation of isolated cells or organs.

In the past,the criteria of complete and persistent cessation of respiration and circulation over a continuous period or several minutes remained the hallmark of medical certification of death.

When transplant surgery is involved,brain death should be certified by at least two doctors not connected with the transplant team.

The most helpful aid in the diagnoses of death is the EEG.

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

DIAGNOSIS OF BRAINSTEM DEATH

EXCLUSIONS

1. Patient may be under effect of drugs,
   eg:- therapeutic overdoses.
2. Core temperature of body is below35^{o}C,
   hypothermia.
3. Severe metabolic or endocrine disturbances that may lead to severe irreversible coma,
   eg:- diabetes.

PRECONDITIONS OF DIAGNOSIS

- Patient must be deeply comatose
- Patient must be maintained on a ventilator
- Cause of the coma must be known

Cause of Coma;

Evidence of Irreversible Structural Brain Damage.

Complete Loss of Brainstem Function;

Brainstem reflexes like pupillary,corneal,facial,oculo-cephalic and oculo-vestibular reflexes should all be absent.

TESTS TO BE PERFORMED

- Before the tests, it is ensured that core temperature of body is above 35°C
- Cranial nerves that pass through brain stem are tested.

PERSONNEL WHO SHOULD PERFORM THE TESTS

- Must be performed by 2 medical practitioners
- Doctors involved should be experts
- Transplant surgeons under no circumstances can perform the test
- At least one of the doctors should be of consultant status, junior doctors are not allowed
- Each doctor should perform the test twice

BRAIN STEM REFLEXES

1. Pupils are fixed in diameter and do not respond to changes in intensity of light
2. No corneal reflex
3. Vestibulo-ocular reflexes are absent (no ocular movement after instillation of cold water into outer ears)
4. No motor responses within the cranial nerve distribution can be elicited by painful stimulation
5. No gag reflex
6. No respiratory movements occur when patient is disconnected from ventilator (long enough to ensure CO_2 concentration rises above the threshold to stimulate respiration)

Patient should remain apnoic after disconnection from the ventilator,long enough to ensure that the arterial carbon dioxide tension is above 8kPa which is the level capable of driving the respiratory center.

- When two doctors have performed these tests twice with negative results, the patient is pronounced dead and a death certificate can be issued.

THE END