

GROUP-2

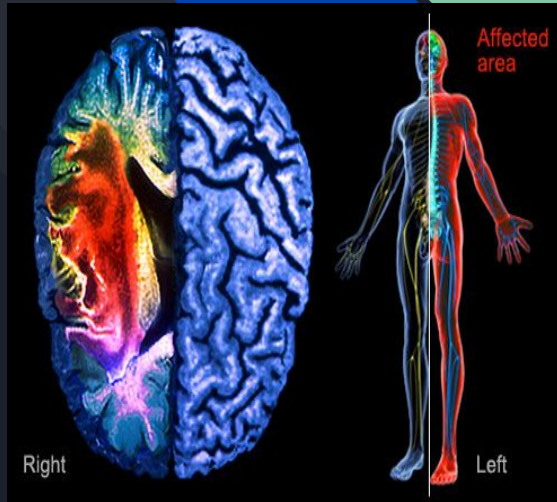
# *BRAIN DEATH*



*BM1030-BIO ENGG*  
*INSTRUCTOR-RENU JOHN*

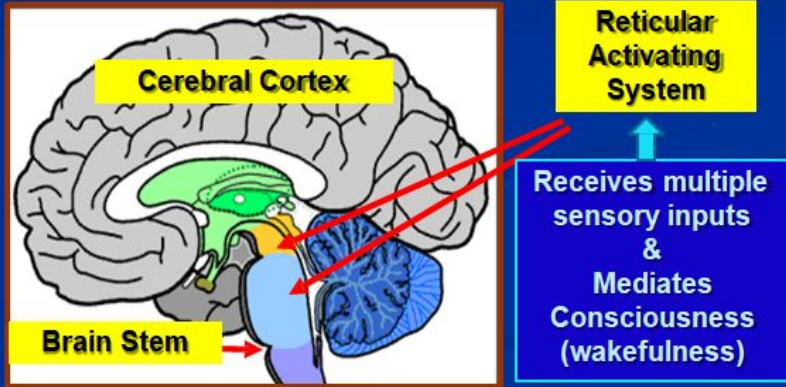
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# WHAT IS BRAIN DEATH?

## Normal Brain Anatomy

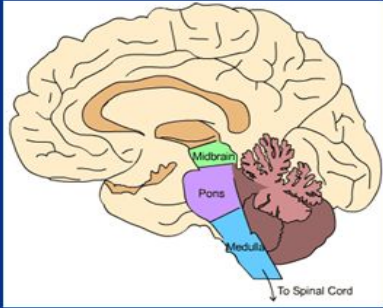


- *Brain Death is an Irreversible form of Unconsciousness Characterised by the Loss of brain function while the Heart continues to beat.*
- *Absence of Apparent brain functions is not enough, evidence of irreversibility is also required. Brain death is different from State of Vegetation.*

# WHO IS DECLARED AS BRAIN DEAD?

- *Absence of Cerebral Function*
- *Absence of Brain Stem Reflexes.*

## Brain Stem : Functions



### Medulla

Cranial Nerve IX, X

- Pharyngeal (Gag) Reflex
- Tracheal (Cough) Reflex

Respiration

## Cerebral Cortex: Function

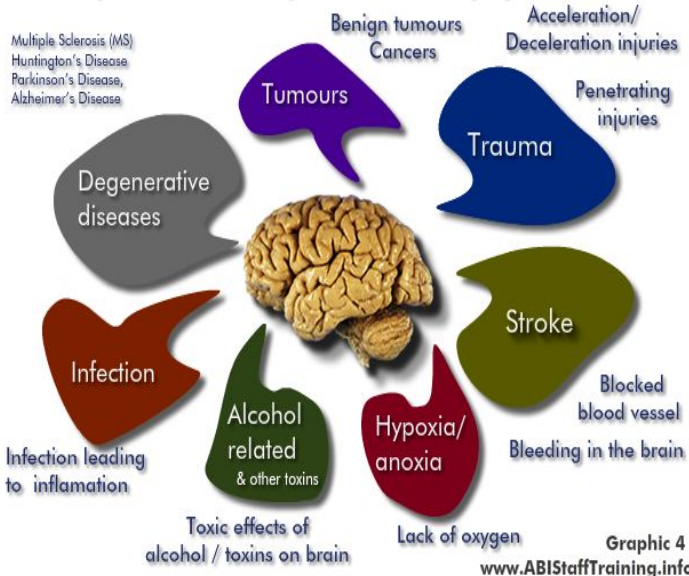


- Cognition
- Voluntary Movement
- Sensation



# WHAT CAUSES BRAIN DEATH?

## Primary causes of acquired brain injury



*Brain death is broadly divided into two types:*

- 1. Primary Brain death*
- 2. Secondary Brain death*

# PRIMARY BRAIN DEATH:

- ❖ *Brain tumor or traumatic injury may cause the brain to swell and lead to death as well.*
- ❖ *Death of brain may occur from accidental injuries or illness.*
- ❖ *Infections such as encephalitis.*
- ❖ *A brain haemorrhage stroke.*

## SECONDARY BRAIN DEATH:

- ❖ *High blood pressure can also cause bleeding in the brain and result in the death.*
- ❖ *Cardiac arrest that is when heart stops beating and the brain is starved of oxygen.*
- ❖ *A blood clot-A blockage in blood vessel that disturbs or blocks the flow of blood around body.*
- ❖ *Cerebrovascular injury i.e stroke or aneurysm.*

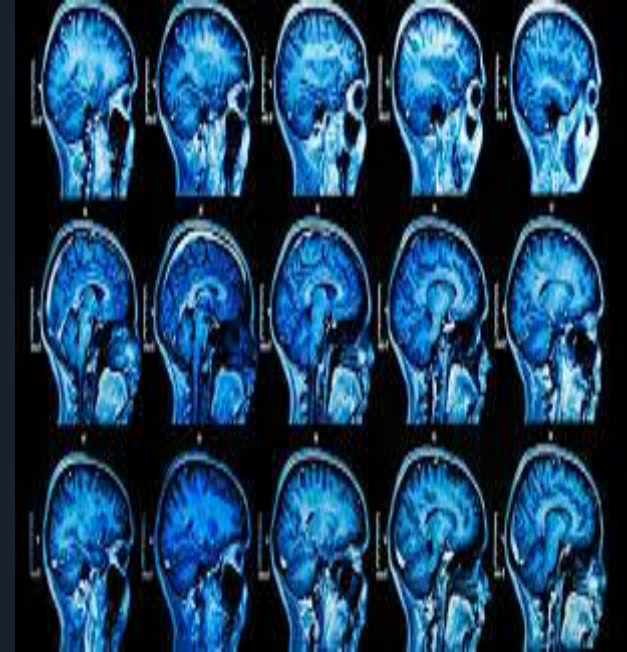
# DIAGNOSIS OF BRAIN DEATH

- *Identification of history or physical examination findings that provide a clear etiology of brain dysfunction.*
- *The determination of brain death requires the identification of the proximate cause and irreversibility of coma. Severe head injury, hypertensive intracerebral hemorrhage, aneurysmal subarachnoid hemorrhage, hypoxic-ischemic brain insults and fulminant hepatic failure are potential causes of irreversible loss of brain function.*
- *The evaluation of a potentially irreversible coma should include, as may be appropriate to the particular case; clinical or neuro-imaging evidence of an acute CNS catastrophe that is compatible with the clinical diagnosis of brain death.*



# STANDARD PROTOCOL OF BRAIN DEATH DIAGNOSIS

- ❑ *This state of the brain is not be grouped together with an ordinary coma (even a very deep one), as long some functions of the brain remain.*
- ❑ *Brainstem reflexes are determined on the basis of gag and cough reflexes, spontaneous eye position, corneal reflexes, pupillary reactivity, and oculocephalic reflexes.*
- ❑ *Apnea is a positive/negative test that monitors the respiratory movements and partial pressures of some gases, while the patient is momentarily placed in an oxygen rich environment. A positive result adds weight to the case that suggests that the patient is brain dead.*



# DIAGNOSIS OF BRAIN DEATH

- ❑ *Before doing the Apnea Test, the doctor must make sure that the patient meets the below mentioned prerequisites.*
  1. *Normotension (Blood pressure is within the normal range)*
  2. *Absence of hypoxia (adequate oxygen supply at the tissue level)*
  3. *Eucapnia (healthy concentration of CO<sub>2</sub> in the blood)*
  4. *Normothermia (a condition where body temperature is normal)*
  5. *Euvolemia (the presence of normal amount of blood)*
  6. *No prior evidence of CO<sub>2</sub> retention (chronic pulmonary obstructive disease, severe obesity)*

# WHY BRAIN DEATH CERTIFICATION IS IMPORTANT??

- *A brain dead person must be certified for the purpose of organ donation and transplantation in India.*
- *If any brain dead person is not certified, the heart cannot be donated, even though he was able to donate it, due to misconception in death and brain dead.*
- *Once brain death is diagnosed as per the existing legal and clinical requirements and the certification process is completed, ICU care will be continued only if organs are to be retrieved for possible donation. If organ donation is not a possibility, then all care will be stopped so that the much valuable ICU resources are not wasted and may be utilised for a salvageable person.*





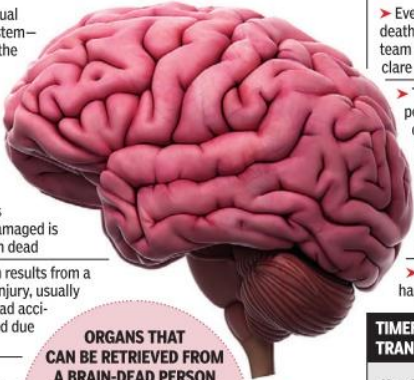
# PROBLEMS WITH EXISTING PROTOCOLS

- *There are many prerequisites for the apnea test, if the patient doesn't meet the prerequisites the diagnosis will be difficult.*
- *EEG is also used as a protocol to diagnose brain death. But, there are cases in which EEG may be ineffective in measuring the brain activity accurately.*
- *Presence of drugs complicates the process of determination of brain death, as they may mask the central nervous system activity.*

# BRAIN DEATH-WHY STUDY IT?

- ❑ According to a paper by Toshiyuki Shiogai, brain death constitutes 1% of all deaths.
- ❑ Another paper reported around 4000 deaths in a year in Britain.
- ❑ Head injury due to road traffic accidents account for 50% of brain deaths and imagine how many accidents occur in our country in a day.
- ❑ There is an estimate of around 140,000 road fatalities in India, in a year.
- ❑ In a study conducted on 137 brain dead cases, 3 of 8 cases, 5 of 12 cases, 3 of 13 cases, 13 of 25 cases, 16 of 29 cases, and 21 of 50 cases became a donor in 2011, 2012, 2013, 2014, 2015, and 2016, respectively.

## IRREPARABLE DAMAGE



➤ Any individual whose brain stem—lower part of the brain that's connected to the spinal cord and is responsible for breathing, blood pressure, heartbeat—is irreparably damaged is declared brain dead

➤ Brain death results from a severe brain injury, usually following a road accident or a bleed due to stroke

➤ The brain swells up after an injury but it cannot expand much as it's contained within the skull made of tough bone

➤ When the pressure in the brain becomes greater than the pressure of the heart, the latter is unable to pump blood to the brain

➤ This lack of blood flow deprives the brain of oxygen leading to its irreversible death

**ORGANS THAT CAN BE RETRIEVED FROM A BRAIN-DEAD PERSON**

**Solid organs** | Kidneys, liver, lungs, heart, intestine, pancreas

**Tissues** | Corneas, skin, heart valves, cartilage, bones, vessels

➤ It is a legal form of death as much as death by cardiac arrest

➤ In order to keep the organs alive, a ventilator continues to blow air into lungs, while the heart continues to receive oxygenated blood

➤ The heart beats for some time—this does not mean the person is alive, or there is chance of recovery

### HOW IS BRAIN STEM DEATH DECLARED?

➤ Every hosp has a brain death committee, involving team of four doctors to declare a person brain-dead

➤ The team has to perform apnea tests to check if the patient can breathe without aid, has any pupil response to light and responds to pain

➤ Tests are repeated twice in six hours

➤ Brain death can happen only in an ICU

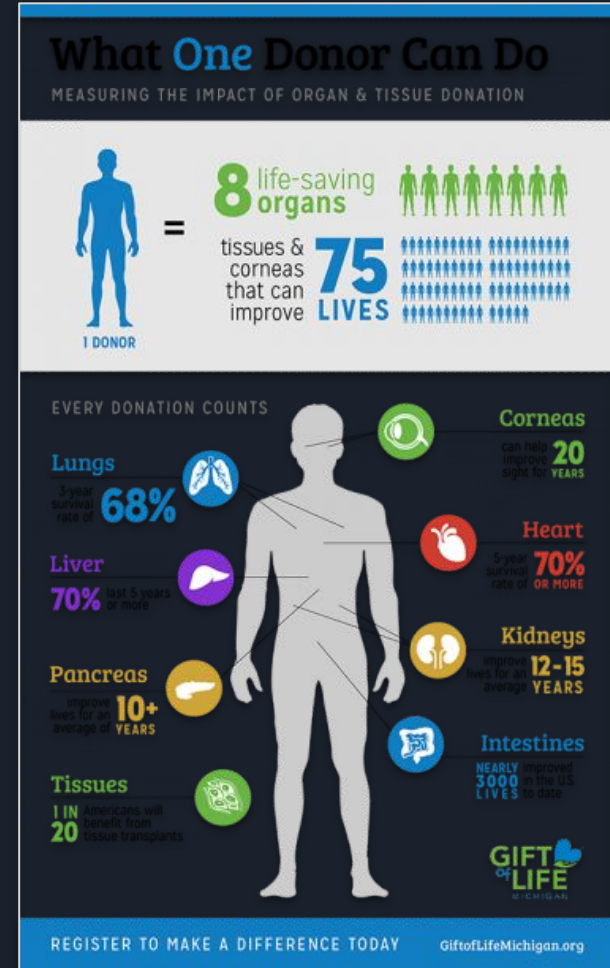
### TIMEFRAME FOR ORGAN TRANSPLANTATION

Heart <b>4-6 hours</b>	Intestine <b>6-10 hours</b>
Lungs <b>4-6 hours</b>	Kidneys <b>24-48 hours</b>
Liver <b>12-15 hours</b>	Pancreas <b>12-14 hours</b>



# A DONATION IN TIME CAN DO WONDERS AND THE STUDY ON BRAIN DEATH MAKES THOSE WONDERS POSSIBLE

- ❑ *The notion of death is far vague than we realize. One can't define death completely.*
- ❑ *But the study on brain death gives us ability to analyse the fine line between dead and alive-brain dead.*
- ❑ *Lot of work goes into identifying whether a person is dead or not.*
- ❑ *As many ethical bounds arise from a sensitive judgement, it needs to be scientifically backed up and justful.*
- ❑ *If successful in determining brain death accurately, we can save many lives.*
- ❑ *There is a very important need for efficient study, to avoid unethical and illegal practice by doctors.*





# 20%

- ❑ *Retrospective studies from Canada indicate that approximately 20% of patients misdiagnosed as "brain-dead" are in fact conscious and have the potential to recover from traumatic brain injuries.*
- ❑ *This misdiagnosis can have fatal consequences that can result when physicians and loved ones "pull the plug" on life support systems that are keeping patients alive. New technology that detects brain activity could be the answer.*



# PROPOSAL TO IMPROVISE THE DIAGNOSIS

- ❑ *In the case of EEG, we need to first check whether EEG is measuring the brain activity efficiently in a normal person. And then use it to diagnose the patient.*
- ❑ *The diagnosis can be aided by rising technology. Many Algorithms in machine learning are being developed to improvise diagnosis of various diseases. This can also be used to develop algorithms for brain death diagnosis.*



*Thanks for giving  
us this tremendous  
opportunity.*