

BRAIN DEATH

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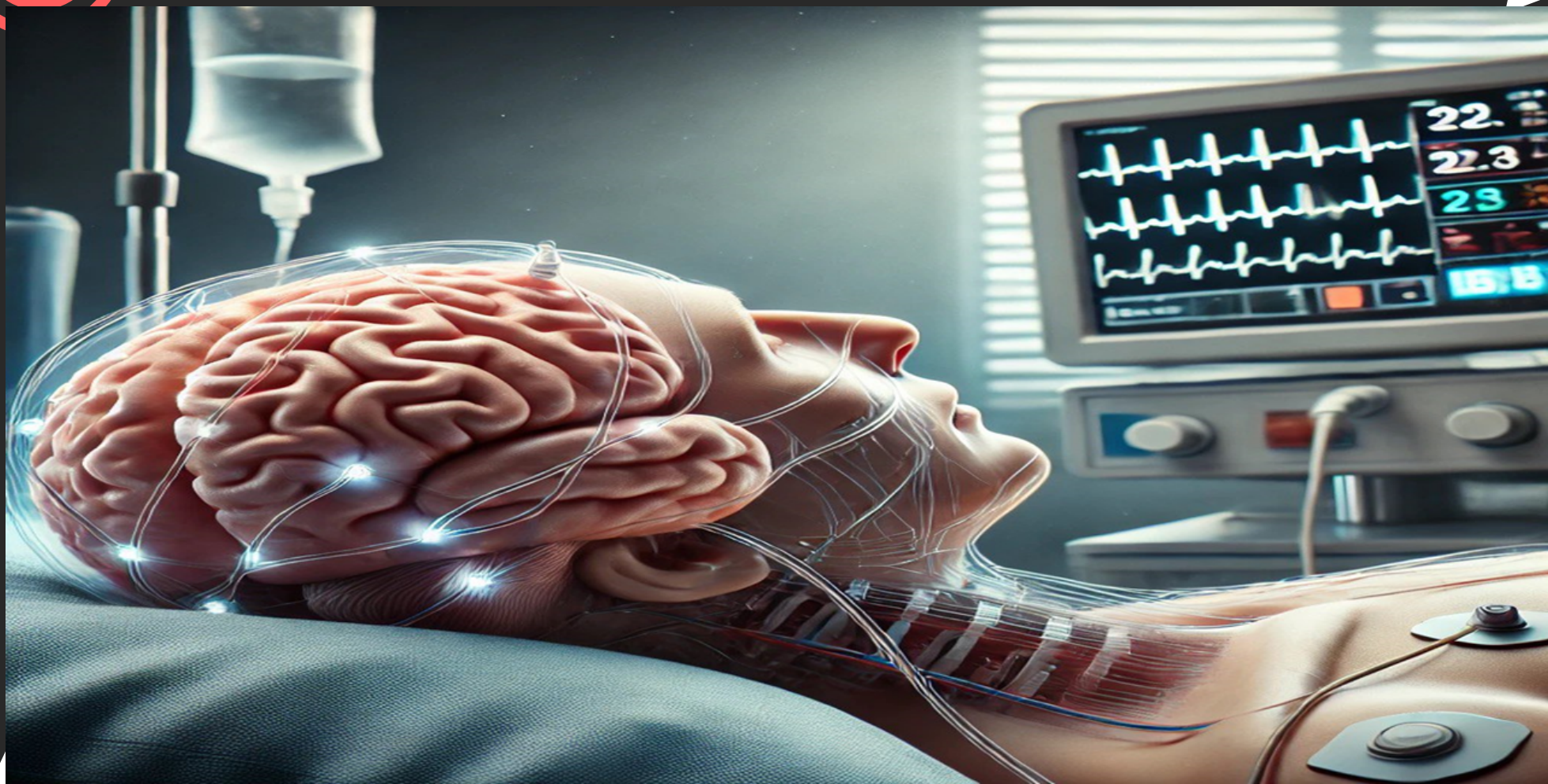
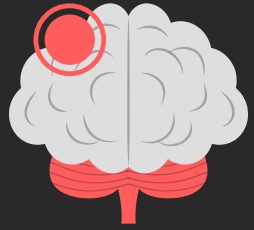


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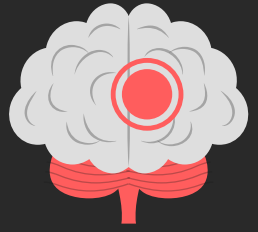
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Death and its types



What do we mean by **death** ?



Death is an irreversible , biological event that consists of permanent cessation of the critical function of the organism as a whole , especially respiration and heart beat.





What do we mean by clinical **death** ?

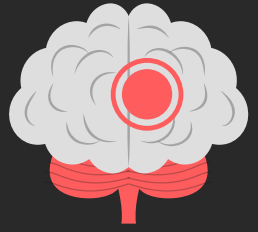


**Clinical death is the
cessation of the circulatory
and respiratory functions.**



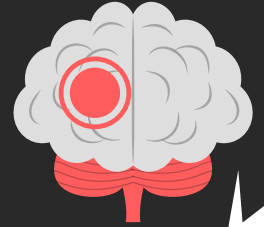
What do we mean by **Brain death** ?

Brain death (aka Biological or Legal death) is the irreversible damage and loss of functions of the entire brain (the cerebrum and the brain stem) which results in loss of consciousness and termination of vital signals from the brain stem.



Survival window

What does **survival window** mean ?



When it comes to the brain , the survival window refers to the critical time period during which the brain can survive without Oxygen before irreversible damage occurs.






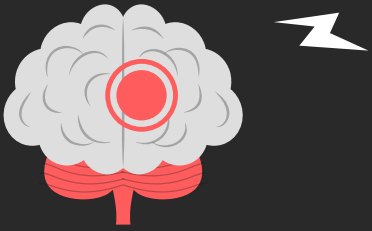
Survival window

Clinical death will eventually progress into brain death , unless we revive the circulatory and respiratory systems by CPR and defibrillation to limit the brain damage.

Brain damage starts as early as 4-10 minutes after clinical death.

So , basically those 4-10 minutes are our " survival window " .





Death pronouncement



Two physicians must be involved in examining then announcing death.

Criteria they should meet :

- 1- 5 years post bachelor degree of medicine and surgery.
- 2- Preferably neurologist or neurosurgeon.
- 3- They must not be previously involved with patient care.
- 4- They must not be with the organ transplant team.





When is the patient **pronounced dead** ?

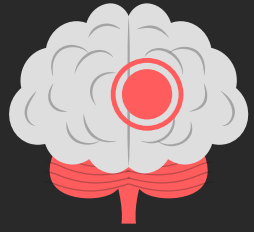
1- GCS = 3

2- loss of brain stem reflexes.

3- absent motor activity.

4- positive apnea test (done twice 12 hours apart).





Glasgow coma scale



Glasgow coma **scale**

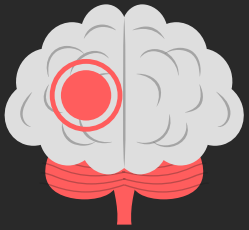
The Glasgow Coma Scale (GCS) was developed in 1974 by Graham Teasdale and Bryan Jennett, both professors of neurosurgery at the University of Glasgow in Scotland. It was created to provide a standardized way to assess the level of consciousness in patients who had suffered a head injury, particularly in emergency settings.

The GCS measures three key aspects of a patient's response:

1. Eye opening (E)
2. Verbal response (V)
3. Motor response (M)

TABLE 38-2**Glasgow Coma Scale**

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	<i>Best response</i>	15
	<i>Comatose client</i>	8 or less
	<i>Totally unresponsive</i>	3



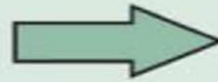
Glasgow coma **scale**

Assess responses in
three domains

Eye (score range 1-4)

Motor (score range 1-6)

Verbal (score range 1-5)



Add scores from the
three components to
give a sum score (3-15)

GCS 13-15: mild TBI

GCS 9-12: moderate TBI

GCS 3-8: severe TBI

Glasgow coma scale

Clinical tips

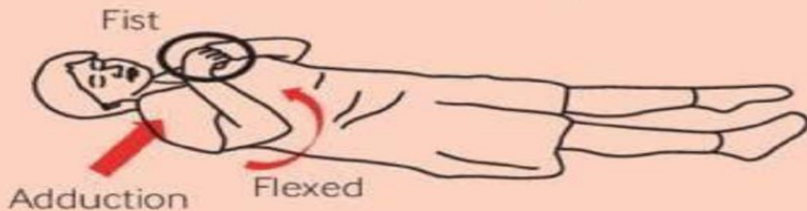
Localising to pain



Flexion/withdrawal to pain

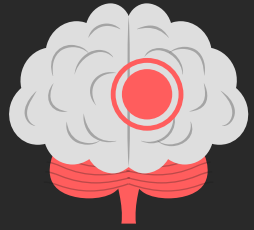


Abnormal flexion to pain



Extension to pain





04

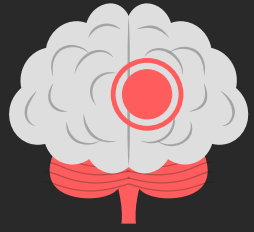
Examination



Examination

Before the examination , there are 4 things should be stabilized :

- 1- Stable vital signs.
- 2- Body temperature > 34 C.
- 3- Normal electrolytes and a free toxicology screen.
- 4- Normal PCO₂ level (35-45 mmHg).



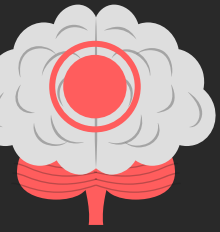
05

BRAIN STEM REFLEXES

BRAIN STEM REFLEXES

Brain stem reflexes are involuntary responses that indicate brain activity. Common reflexes include the pupillary reflex and the corneal reflex. Absence of these reflexes is a significant indicator in the assessment of brain death and helps determine the integrity of brain function.

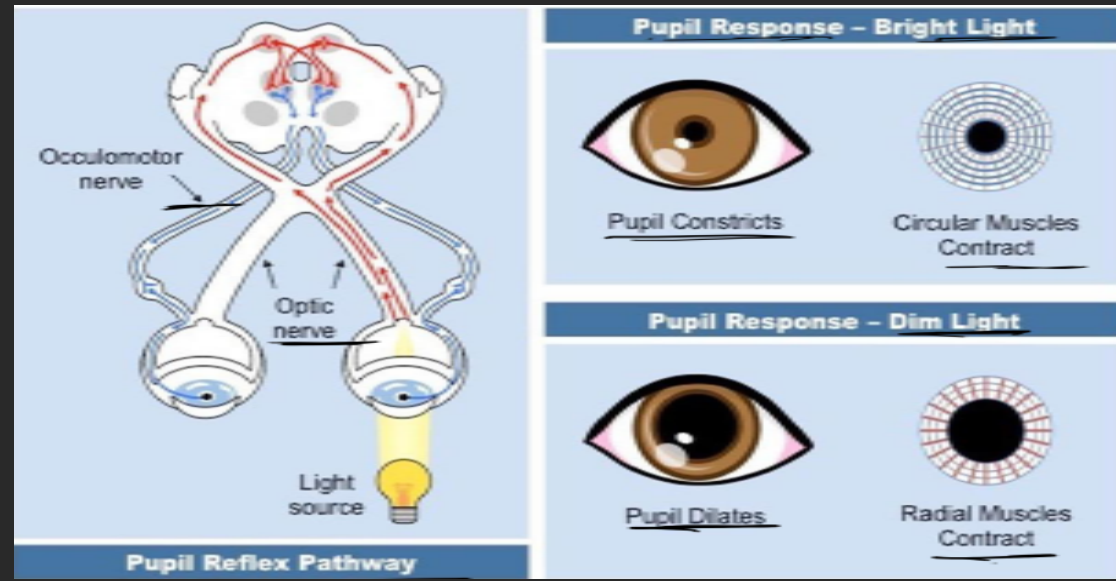




Pupillary Reflex **Assessment**



The pupillary reflex involves checking the reaction of pupils to light. In brain death, pupils remain fixed and dilated. This reflex is one of the first indicators assessed in determining brain function.



Corneal Reflex Testing

The corneal reflex is tested by lightly touching the cornea. In a brain-dead patient, there is no blink response. This reflex is critical in assessing the integrity of brain stem function

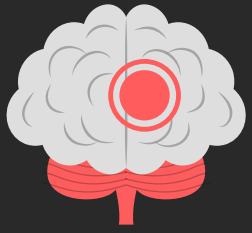
CN V – Trigeminal



The corneal reflex tests the afferent (sensory) arc of CN V, and the efferent (motor) arc of CN VII.

• Corneal Reflex Test

- Usually not done if light touch is intact
- Instruct the patient to look up and away from you.
- Approaching the patient laterally, out of his line of vision, and avoiding the eyelashes, touch the cornea lightly with a fine wisp of cotton.
- Look for blinking of the eyes, the normal reaction to this stimulus.
- Be aware that use of contact lenses frequently diminishes, or may even eliminate, the corneal reflex response.



Gag and Cough reflex



Additional reflexes such as the gag reflex and cough reflex are also evaluated. The absence of these reflexes supports the diagnosis of brain death and indicates a non-functioning brain stem

Gag and Cough reflex



- Area tested – CN IX and X , medulla.
- Brain death – absence of both cough and gag reflex.

Brain stem reflexes

	Afferent	Efferent
Corneal reflex	ophthalmic	facial
Papillary reflex	optic	oculomotor
Gag reflex	glossopharyngeal	vagus
Tracheal reflex	vagus	vagus

Important note :

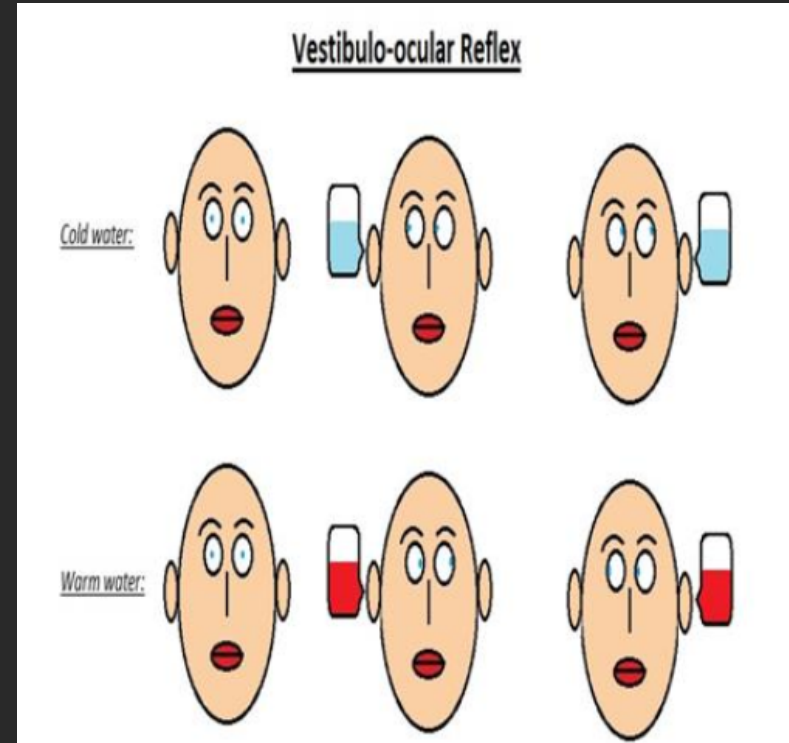
vestibulo-ocular/oculocephalic reflex; the most clinically important reflex to diagnose brain death

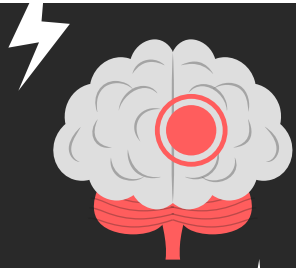
Cold caloric

The Cold Caloric Test involves irrigating the ear canal with cold water and warm water to assess vestibular function. This test evaluates the brainstem's response to temperature changes, helping to identify potential neurological deficits. A normal response indicates intact brainstem function, while an abnormal response can signal brain death.

Initial eye movement = CSWO = Cold Same, Warm Opposite.

Nystagmus = COWS = Cold Opposite, Warm Same





Doll's Eyes

The Doll's Eyes Test assesses the oculoccephalic reflex, which helps determine brainstem integrity. When the head is turned, the eyes should move in the opposite direction if the brainstem is functioning properly. A lack of this reflex can indicate severe neurological impairment.



Apnea Test

The apnea test is a critical component in diagnosing brain death. It measures the ability to breathe independently. If the patient does not initiate breathing when carbon dioxide levels rise, it indicates the absence of brain stem function, supporting the diagnosis of brain death.



- We test for the **respiratory centers in the medulla oblongata** by **sensitizing them with increasing PaCO₂** up to **60mmHg** (we anticipate visible signs of respiratory musculature contraction if the brain stem isn't severely damaged beyond repair).
- A common method of apnea testing involves **disconnection of mechanical ventilation from the patient**, followed by the insertion of a catheter or cannula into the endotracheal tube, down to the level of the carina, through which oxygen is delivered.

before we start,

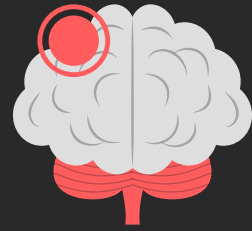
we **hyperventilate** the patient with **100% O₂**

- **CPAP** into tube with **6L** of O₂/min
- **ABG every min** for **8-10 min**

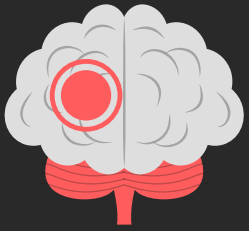
- we make sure that **systolic blood pressure doesn't fall below 90mmHG** during the entire test and the **oxygen saturation level below 85%** or else we **stop and end the test and repeat it else time**



Positive Or Negative



brain death	indeterminate result
respiratory movements are absent	respiratory movements are detected
arterial PCO_2 is 60 mm Hg (option: 20 mm Hg increase in PCO_2 over a baseline normal PCO_2)	If the PCO_2 is < 60 mm Hg or PCO_2 increase is < 20 mm Hg over baseline normal PCO_2
the apnea test is positive	the result is indeterminate and an additional confirmatory test can be considered



After confirmation of brainstem death

- If the patient meets all criteria for brain death on both examinations, this should be noted in the medical record at the time of the second exam.
- This time becomes the time of legal death declaration.
- If organ donation is considered, the situation is discussed with the family, primarily to ascertain the patient's wishes about donation (if known).
- If donation is possible, intensive care of the body must be continued



Thanks!

