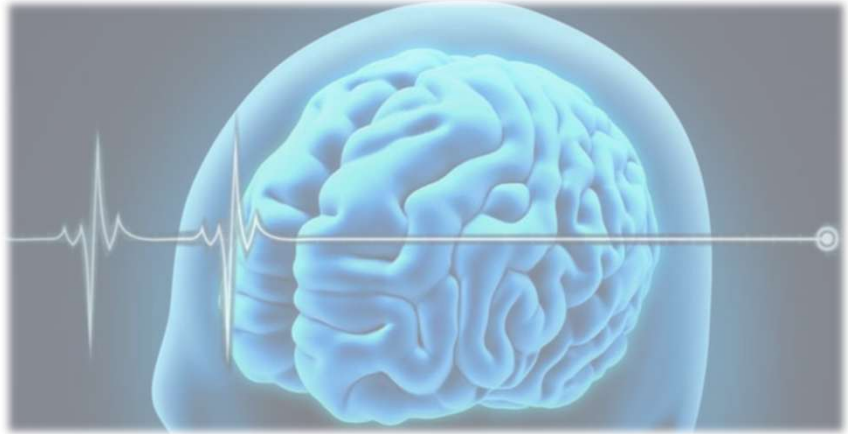




# Brain Death

By  
Asst. Lect. Ahmed M. Radeef  
M.Sc. Anesthesia technology




## Brain Death: Definition

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- Defined by the Uniform Determination of Death Act
- Irreversible cessation of all functions of the entire brain, including the brainstem
- Diagnosis is clinical based on coma, absent brainstem reflexes, and apnea


## A. Prerequisites for Brain Death Examination

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- Hemodynamic stability: SBP  $\geq 100$  mmHg
  - Normothermia: Core temperature  $>36^{\circ}\text{C}$
  - Absence of CNS depressants: No sedatives or neuromuscular blockers
  - Metabolic stability: euglycemia, normal thyroid function
  - Cause of coma known and sufficient to explain brain function loss
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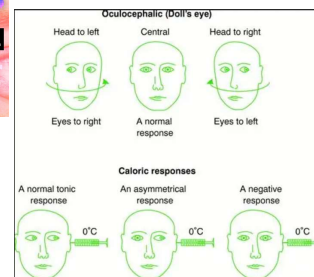
## Clinical Criteria: Coma

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- Patient must exhibit irreversible, unresponsive coma
  - No motor response to deep pain
  - No facial grimacing to noxious stimuli
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# Clinical Criteria: Absence of Brainstem Reflexes

- No pupillary light reaction
- No corneal reflex
- No oculcephalic reflex (doll's eyes)
- No oculovestibular reflex (caloric testing)
- No gag reflex
- No cough reflex on tracheal suction



## B. Apnea Test

### Procedure:

1. **Pre-oxygenation and Baseline:** The patient is pre-oxygenated with 100% FiO<sub>2</sub> for at least 10 minutes. Ventilator settings are adjusted (e.g., reduced rate) to establish a baseline PaCO<sub>2</sub> via an arterial blood gas (ABG), provided oxygen saturation (SpO<sub>2</sub>) remains >95%.
2. **Disconnection:** The patient is disconnected from the ventilator. Apneic oxygenation is maintained by insufflating 100% O<sub>2</sub> via a catheter through the endotracheal tube.


## Apnea Test

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**3. Observation and Target:** The patient is observed for any respiratory effort. The goal is for the PaCO<sub>2</sub> to rise by  $\geq 20$  mm Hg above the baseline. The PaCO<sub>2</sub> typically rises at a rate of 3 mm Hg per minute, making a test duration of 6–7 minutes usually sufficient.


**4. Confirmation:** A final ABG is obtained. The absence of respiratory effort with a PaCO<sub>2</sub>  $\geq$  the target threshold (typically  $\geq 60$  mm Hg) confirms apnea.

**5. Abortion Criteria:** The test must be aborted if systolic blood pressure falls below 90 mm Hg or if SpO<sub>2</sub> falls below 85% for more than 30 seconds.



## C. Ancillary Tests: Indications

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- Used when clinical exam or apnea test cannot be reliably performed
  - Examples of situations requiring ancillary tests:
    - Severe facial trauma
    - Middle ear disease preventing calorics
    - High ventilatory requirement preventing apnea test
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## Ancillary Tests: Types

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➤ Cerebral angiography (CTA/MRA)

➤ Nuclear scintigraphy

➤ Electroencephalography (EEG)

Note: Reliability varies, must interpret in clinical context



## D. Lazarus Sign

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➤ Spontaneous limb or torso movements in brain-dead patients

➤ Caused by spinal reflexes, not brain activity

➤ Often triggered by hypoxemia or spinal cord ischemia after ventilator disconnection


## Legal Requirements & Documentation

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- Examination must be performed by qualified physicians
  - Some jurisdictions require two separate examinations
  - Documentation must include prerequisites, full neurologic exam, apnea test results
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## E. Potential Organ Donor Considerations

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- Brain death diagnosis often precedes organ donation process
  - Donor management in ICU is crucial to preserve organ viability
  - Follow institutional guidelines for organ procurement
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## Brain Death Checklist

Step	Component	Key Criteria & Conditions
1	Prerequisites	<ul style="list-style-type: none"> <li>• Systolic BP <math>\geq 100</math> mm Hg</li> <li>• Core Temperature <math>&gt; 36^{\circ}\text{C}</math> (<math>&gt; 96.8^{\circ}\text{F}</math>)</li> <li>• Metabolic Status: Normal thyroid/adrenal function &amp; Euglycemia (normal blood sugar)</li> <li>• No Confounding Drugs: Absence of CNS depressants &amp; neuromuscular blocking agents</li> </ul>
2	Establish Cause of Coma	The identified cause of coma is known and is sufficient to account for the irreversible loss of brain function.
3	Absence of Cortical & Brainstem Function	<ul style="list-style-type: none"> <li>• Coma: The patient is unconscious.</li> <li>• No Motor Response: Absence of facial grimacing to noxious stimulus.</li> <li>• Absent Brainstem Reflexes:               <ul style="list-style-type: none"> <li>- Pupillary response to light</li> <li>- Corneal reflex</li> <li>- Gag and cough reflexes</li> <li>- Oculocephalic reflex (doll's eyes)</li> <li>- Oculovestibular reflex (caloric test)</li> </ul> </li> </ul>
4	Apnea Test	No spontaneous breathing efforts are observed when the arterial $\text{PCO}_2$ ( $\text{PaCO}_2$ ) rises to $\geq 20$ mm Hg above the patient's baseline level (or $\geq 60$ mm Hg absolute).
5	Confirmation & Legal Requirements	<ul style="list-style-type: none"> <li>• The examination must be performed by qualified physicians as per institutional and state law.</li> <li>• Some jurisdictions require two separate examinations.</li> </ul>

