



UPDATE: DETERMINING BRAIN DEATH IN ADULTS

This is a summary of the American Academy of Neurology (AAN) guideline update (*Neurology*® 2010;74:1911–1918) on determining brain death in adults.

Please refer to the full guideline at www.aan.com for more information, including the AAN’s definitions of the classification of evidence for studies of diagnostic accuracy, the classification of evidence for screening studies, and the classification of recommendations.

Are there patients who fulfill the clinical criteria of brain death who recover brain function?	
Insufficient evidence	The criteria for the determination of brain death given in the 1995 AAN practice parameter have not been invalidated by published reports of neurologic recovery in patients who fulfill these criteria (Level U).
What is an adequate observation period to ensure that cessation of neurologic function is permanent?	
Insufficient evidence	There is insufficient evidence to determine the minimally acceptable observation period to ensure that neurologic functions have ceased irreversibly (Level U).
Are complex motor movements that falsely suggest retained brain function sometimes observed in brain death?	
Weak evidence	Complex-spontaneous motor movements and false-positive triggering of the ventilator may occur in patients who are brain dead (Level C).
What is the comparative safety of techniques for determining apnea?	
Insufficient evidence	There is insufficient evidence to determine the comparative safety of techniques used for apnea testing (Level U).
Are there new ancillary tests that accurately identify patients with brain death?	
Insufficient evidence	There is insufficient evidence to determine if newer ancillary tests accurately confirm the cessation of function of the entire brain (Level U).

CLINICAL CONTEXT*

This review highlights severe limitations in the current evidence base. Indeed, there is only one study that prospectively derived criteria for the determination of brain death.

Despite the paucity of evidence, much of the framework necessary for the development of “accepted medical standards” for the declaration of brain death is based on straightforward principles. These principles can be derived from the definition of brain death provided by the Uniform Determination of Death Act (UDDA). To determine “cessation of all functions of the entire brain, including the brain stem,” physicians must determine the presence of unresponsive coma, the absence of brainstem reflexes, and the absence of respiratory drive after a CO₂ challenge. To ensure that the cessation of brain function is “irreversible,” physicians must determine the cause of coma, exclude mimicking medical conditions, and observe the patient for a period of time to exclude the possibility of recovery.

The UDDA-derived principles define the essential elements needed to determine brain death. However, because of the deficiencies in the evidence base, clinicians must exercise considerable judgment when applying the criteria in specific circumstances.

Figure 1. Checklist for Determination of Brain Death

Prerequisites (all must be checked)

- Coma, irreversible and cause known.
- Neuroimaging explains coma.
- CNS depressant drug effect absent (if indicated toxicology screen; if barbiturates given, serum level <10 µg/mL).
- No evidence of residual paralytics (electrical stimulation if paralytics used).
- Absence of severe acid-base, electrolyte, endocrine abnormality.
- Normothermia or mild hypothermia (core temperature >36°C).
- Systolic blood pressure ≥100 mm Hg.
- No spontaneous respirations.

Examination (all must be checked)

- Pupils nonreactive to bright light.
- Corneal reflex absent.
- Oculocephalic reflex absent (tested only if C-spine integrity ensured).
- Oculovestibular reflex absent.
- No facial movement to noxious stimuli at supraorbital nerve, temporomandibular joint.
- Gag reflex absent.
- Cough reflex absent to tracheal suctioning.
- Absence of motor response to noxious stimuli in all four limbs (spinally mediated reflexes are permissible).

Apnea testing (all must be checked)

- Patient is hemodynamically stable.
- Ventilator adjusted to provide normocarbica (PaCO₂ 35–45 mm Hg).
- Patient preoxygenated with 100% FiO₂ for >10 minutes to PaO₂>200 mm Hg.
- Patient well-oxygenated with a positive end-expiratory pressure (PEEP) of 5 cm of water.
- Provide oxygen via a suction catheter to the level of the carina at 6 L/min or attach T-piece with continuous positive airway pressure (CPAP) at 10 cm H₂O.
- Disconnect ventilator.
- Spontaneous respirations absent.
- Arterial blood gas drawn at 8–10 minutes, patient reconnected to ventilator.
- PCO₂ ≥60 mm Hg, or 20 mm Hg rise from normal baseline value.

OR:

- Apnea test aborted.

Ancillary testing (only one needs to be performed) (to be ordered only if clinical examination cannot be fully performed due to patient factors, or if apnea testing inconclusive or aborted)

- Cerebral angiogram
- HMPAO SPECT
- EEG
- TCD

Time of death (DD/MM/YY) _____/_____/_____

Name of physician and signature

This is an educational service of the American Academy of Neurology. It is designed to provide members with evidence-based guideline recommendations to assist the decision making in patient care. It is based on an assessment of current scientific and clinical information and is not intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, and are based on the circumstances involved. Physicians are encouraged to carefully review the full AAN guidelines so they understand all recommendations associated with care of these patients.

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