Brain Death Determination

Brain Death Determination: Outline

- Definition
- Confounding factors
- Clinical examination
- Apnea test
- Confirmatory testing
- Communicating the diagnosis
- Ethical issues

Definition

- Brain death remains the preferred terminology to summarize a clinical state that involves an apneic patient with irreversible coma and absent brainstem reflexes.
**Historical background**

- The diagnosis of brain death remained theoretical until the 1950s
- The advent of positive pressure ventilation in 1952 allowed for continued support of comatose patients
- In 1959, Pierre Mollaret and Maurice Goulon published an article “Le coma dépasse”
- 1968 a committee commissioned by Harvard Medical School examined irreversible coma as a new criterion for death
- 1977 the NIH sponsored a multicenter US collaborative study of cerebral death to standardize the criteria

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**Anatomic progression**

Brain death is a result of an unrelenting acute brain injury, typically progressing from a hemispheric lesion to a brainstem lesion.

Brainstem injury mostly advances caudally from the mesencephalon to the medulla oblongata with the brain stem reflexes disappearing in a sequential fashion.

**Predictable course**

- The progressive loss of brainstem reflexes
- Suddenly breathing only at the set ventilator rate, and new hypotension and polyuria requiring vasopressors and vasopressin.
- Loss of heart rate variability
Epidemiology

- Early estimates have placed the prevalence of brain death among patients with acute brain injury at 10%.
- Early aggressive care, change in referral patterns, early withdrawal of support, or a decision to proceed with a donation after cardiac death protocol may play a role.
- No recoveries after the diagnosis of brain death have been documented in the literature since the adoption of the AAN 1995 guidelines.

Exclude confounding factors

- No lingering effects of prior sedation, other confounding medications, or prior use of illegal drugs or alcohol.
- Calculate 5 to 7 times the drug’s elimination half-life in hours and allow that time to pass before clinical examination is performed.
- Phenobarbital (100 hours), diazepam (40 hours), amitriptyline (24 hours), and lorazepam (15 hours). Midazolam (3 hours).

Exclude confounding factors

- Absence of neuromuscular blockade.
- Absence of severe electrolyte, acid-base, or endocrine disturbances.
- A core temperature of greater than 32°C (89.6°F) must be present, but should preferably be near normothermia (36°C to 37°C [96.8°F to 98.6°F]).
- Systolic blood pressure should be greater than 90 mm Hg.

Common brain death mimics

- High cervical cord injury.
- Fulminant Guillain-Barre syndrome.
- Organophosphate intoxication.
- Baclofen overdose.
- Barbiturate overdose.
- Lidocaine toxicity.
- Delayed Vecuronium clearance.
You need a cause!

- Determining brain death in a patient with repeatedly normal CT scan is never acceptable.
- CT scan should be expected to demonstrate massive brain destruction.

Clinical Exam

- Unresponsive to verbal and painful stimuli.
- No eye opening.
- No motor response (arising from the brain).
- Spinal motor responses are common and may occur with neck flexion and nail bed compression, but are absent with supraorbital nerve compression.
- Triple flexion responses, finger flexion or extension, head turning, and slow arm lifting.

Clinical Exam

Pupils should be midposition (4 mm to 6 mm) and unresponsive to light.

The corneal reflex is tested by squirting water on the cornea or by touching it with a tissue, and no blink response should be seen with any stimulus.

Oculovestibular response (cold caloric) should be absent. The head should be elevated 30 degrees. Approximately 50 mL of ice water is then infused in the external auditory canal. No eye movement should be seen after 2 minutes of observation.

Evaluation of gag and cough reflexes, both of which should be absent.
Apnea test

• Only when all these brainstem reflexes are absent and no breathing effort is apparent
• An absent breathing drive is proven with a carbon dioxide challenge
• Preparation includes preoxygenation with 100% FiO₂, reducing positive end-expiratory pressure [PEEP] to 5 cm of water and drawing a baseline blood gas

Confirmatory Testing

• Confirmatory tests have considerable inaccuracy
• Patients need to meet all clinical criteria before a confirmatory test is ordered
• Currently used in less than 5% of patients diagnosed with brain death
• Best avoided if possible
• False positive and false negative test can occur
• Time of death is when the ancillary test is officially interpreted

Confirmatory Testing

• Mostly used when there is an inability to perform an apnea test (because of poor oxygenation, hemodynamic instability, or evidence of chronic carbon dioxide retention)
• Brain stem reflexes can not be assessed due to facial trauma or preexisting bilateral pupillary abnormalities
Confirmatory Testing

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Brain Death Determination

Confirmatory Testing

Measures cerebral blood flow
- Measures electrical activity
  - EEG

Nuclear Cerebral blood flow
- Cerebral angiography

Brain Death Determination Assessment

Communicating the diagnosis

- Establish a relation with the family before the discussion of brain death
- Avoid language that might be confusing to the family and the staff.
- Avoid using the diagnosis of brain death in patients that have poor neurological condition and are comatose

Communicating the diagnosis

- Families might benefit from witnessing the evaluation of brain death
- More than one meeting might be required
- Communicate the diagnosis to the family in a compassionate but clear, not technical language and give a time of death
- Explain that the patient is medically and legally dead
- The patient has died and the body and organs are being supported by artificial means
- Allow some time for grieving
Ethical Issues

Refusal to accept the diagnosis

- Consider maintaining full support for 2 to 3 days while trying to resolve this issue, asking for assistance from a hospital ethics committee
- Cardiopulmonary resuscitation is not warranted under any circumstances
- If the family refuses to come to an agreement and remains intransigent, legal advice should be obtained.

Commemorative child

- Request to harvest sperm or oocytes for future pregnancies ("a commemorative child")
- The success rate of the entire procedure leading to a successful pregnancy is also less than 30%
- Posthumous semen procurement requires approval and is often refused in the courts.

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Ethical Issues

- Brain death during pregnancy
- Declaring brain death in a child
- Religious beliefs

Key Points

- Significant variability remains among institutions
- Determining brain death starts with excluding confounding factors.
- Therapeutic hypothermia after cardiac arrest may make reliable assessment of neurologic function very difficult.
- An apnea test requires careful preparation and is safe if prerequisites are followed, and apnea tests that fail do so because of inadequate preoxygenation and inadequate oxygen administration.
Key Points

- The most challenging ethical problem related to brain death declaration is how to approach families who refuse to accept that their loved one has passed.

- When families fail to accept brain death, extending full support for a short time may give the family time to reach that acceptance.