

Death By Neurologic Criteria

Death by neurologic criteria, or brain death, is a legal declaration of death in every state¹. Once you pronounce a patient dead, you are under no obligation to do anything else, no matter how much family members may wail. The patient is dead, and arguments about futility are now moot. That said, we do try to be humane about it and we'll often give people a day to arrive and say goodbye.

Stepwise Approach to Brain Death

1. Document the presence of a **terminal, irreversible CNS condition**. This usually requires imaging of some sort. This is the cardinal rule of brain death—you have to know why the patient is dead.
2. Exclude the presence of any medication effects. This can be as simple as a chart review. If the patient has received any neuromuscular blockers, document the presence of 4/4 twitches on train-of-four monitoring. If there is any concern about residual sedative/narcotic effect (especially after a period of hypothermia), administration of 10 mg naloxone IV and 2 mg flumazenil IV is acceptable.
3. Make sure the patient is warm ($\geq 36^{\circ}\text{C}$) and perfused ($\text{MAP} \geq 65$). It's OK to use vasopressors and warming techniques to get to this point.
4. Increase the FiO_2 to 100%, in order to preoxygenate the patient for the apnea test. It's also a good idea to get a baseline ABG.
5. Assess for the following findings during brainstem testing:
 - a. Pupils are midposition or dilated (4-9 mm) and unreactive to light
 - b. No deviation of the eyes from midline during turning of the head from side to side (i.e. cervico-ocular reflex is absent)
 - c. No blinking of either eye while touching the sclera or palpebral conjunctiva with cotton gauze
 - d. No grimacing or other reaction to pressure on the superior orbital ridge
 - e. No decerebrate or decorticate posturing to painful stimulus
 - f. No deviation of the eyes from midline after irrigating each auditory canal with 50 mL of ice water (i.e. vestibulo-ocular reflex is absent)
 - g. No coughing or gagging with suctioning of the endotracheal tube

¹ Except New Jersey, in certain situations.

6. Cut the nasal prongs off of a nasal cannula. Disconnect the ventilator from the endotracheal tube. Pass one of the two small tubes from the nasal cannula down the endotracheal tube and provide oxygen at 4 L/min. Coil the other small tube and use it to keep the small tube in the ETT in place. Observe the patient for ten minutes and then obtain an ABG. The apnea test is considered to be failed if all of the following criteria are met:
 - a. No efforts at spontaneous breathing
 - b. No hemodynamic instability or desaturation requiring abortion of the test before an ABG can be obtained
 - c. The PaCO₂ at the end of the test is ≥ 60 mm Hg, or at least 20 mm Hg over baseline
 - d. The pH at the end of the test is < 7.30

A failed apnea test and the absence of any brainstem reflexes, in the setting of a terminal, irreversible CNS condition, is consistent with a diagnosis of brain death.

In some settings, it may be necessary to get confirmatory testing. The most common reason is due to an anatomic reason (high C-spine injury, severe contractures, blindness) for not performing a full examination or apnea test. Another is the presence of drug intoxication that could make apnea testing unreliable. Thirdly, sometimes a confirmatory test can help family members accept the diagnosis. The two confirmatory tests that we use are:

- Tc⁹⁹ Cerebral Flow Scan. Make sure that both AP and lateral images are obtained. The absence of any radionuclide signal inside the skull is consistent with brain death. This test is easily done at the bedside and is our preferred confirmatory test.
- Cerebral angiography. The absence of any intracerebral blood flow is consistent with brain death. This test is more labor-intensive and requires transport out of the ICU, but it is the “gold standard.”

EEG is probably the worst confirmatory test to get, because it tells you nothing about cerebral blood flow. A flat EEG is seen with brain death, but also with severe drug intoxication and hypothermia. Mechanical ventilators, IV pumps, and fluorescent lights can occasionally produce electrical artifact on the EEG, which may lead you to think the patient is alive when he is not. CT angiography, while appealing, is actually not a good test either because it doesn't provide a dynamic assessment of the circulation the way conventional angiography or nuclear medicine scanning does. It's more of a snapshot in time and can be potentially misleading.

Once you have determined that the patient is dead, it's important to make sure that Lifepoint is able to approach the family to discuss organ donation. Please do not bring this up yourself! Let Lifepoint initiate the conversation. If the family chooses to donate, please assist the process by placing an arterial line, central line, pulmonary artery catheter, and doing a bronchoscopy with BAL.