Policy Requirement

NC law G.S. 90-323

The determination that a person is dead shall be made by a physician licensed to practice medicine applying ordinary and accepted standards of medical practice. Brain death, defined as irreversible cessation of total brain function, may be used as a sole basis for the determination that a person has died, particularly when brain death occurs in the presence of artificially maintained respiratory and circulatory functions. This specific recognition of brain death as a criterion of death of the person shall not preclude the use of other medically recognized criteria for determining whether and when a person has died (1979, c. 715, s. 3.).

The WakeMed Determination of Brain Death, effective 12/04/2019) complies with NC law with the following additional requirements:

- The examining physician MUST be an attending
- Requires 2nd confirmatory consultation (also MUST be an attending)
- ONE of the examining physicians MUST be a neurologist, intensivist or neurosurgeon
- It is recommended that the 2nd confirmatory consultation be from another group (per policy above, could be two trauma attendings as long as one is also an intensivist)
- For patients <1month of age and >37 weeks gestation, two (2) exams must be performed by a licensed physician with a minimum of twenty-four (24) hours between exams.
- For patients <18 years of age and >1 month of age, two (2) exams must be performed by a licensed physician with a minimum of twelve (12) hours between exams.
- For patients >18 years of age there is no defined time between exams.

GENERAL GUIDELINES FOR DETERMINING BRAIN DEATH

Brain death requires the IRREVERSIBLE loss of ALL functions of the ENTIRE brain, including the brainstem. Brain death determination cannot be made in setting of potentially reversible conditions like hypothermia, shock, or drug intoxication without a confirmatory test.

Identify two different examining physicians eligible to make the determination of brain death. They will then, separately, do the following:

1. Review and document prerequisites for clinical testing using the dot phrase “BRAINDEATHAAN2010.”
2. Perform and document a full clinical exam for establishing loss of all function of the brain using the dot phrase “BRAINDEATHAAN2010.”
3. Repeat a full clinical exam at least 24 hours (for patients <1 month of age and >37 weeks gestation), 12 hours (for patients <18 years of age and >1 month of age), or 6 hours apart (for patients >18 years of age). Alternatively, a confirmatory test may be performed. This negates the need for a second exam.

CLINICAL CRITERIA FOR DOCUMENTING THE IRREVERSIBLE LOSS OF ALL FUNCTION OF THE BRAIN (per American Academy of Neurology 2010 Guidelines)

1. Prerequisites (all must be checked)
   - The cause of coma is established and sufficient to account for loss of brain function
□ Neuroimaging is compatible with the clinical diagnosis of brain death
□ CNS depressant drug effect absent. If indicated, obtain toxicology screen. If barbiturates given serum level must be <10mcg/mL
□ No evidence of residual paralytics. Check with train of four if paralytics have been used.
□ Absence of severe acid-base, electrolyte, or endocrine abnormality
□ Core temperature > 36°C
□ Systolic blood pressure > 100 mm Hg. Vasopressors may be required.
□ No spontaneous respirations

2. **Clinical exam for establishing loss of all function of the brain (all must be checked)**
□ Coma (e.g. prolonged unconsciousness)
□ Pupils nonreactive to bright light. They are fixed and dilated in the midline position.
□ Corneal reflex absent. This is demonstrated by squirting the cornea with water and observing no eyelid movement.
□ Oculocephalic reflex (e.g. doll’s eyes) absent. **Test only if C-spine integrity ensured.** This is tested by moving the head side to side and seeing no evidence of eye movement with head movement.
□ Oculovestibular reflex (e.g. cold caloric) absent. This is tested by irrigating the auditory canal with 50 ml of ice water and watching for signs of eye movement for at least one minute.
□ No movement to noxious stimuli. Specifically, no eye, face, or extremity movement to noxious stimuli and no movement of facial muscles when applying deep pressure to the supraorbital ridge and condyles of the temporomandibular joint.
□ Gag reflex absent. Assessed by stimulating the posterior pharynx with a suction catheter.
□ Cough reflex absent. Assessed by advancing the tracheal suction cannula to the level of the carina.
□ Absence of motor response to noxious stimuli in all four limbs. Spinal/peripheral nerve mediated reflexes are permissible, see appendix below.
□ Apnea, as determined by an apnea test.
   • See WakeMed policy **Apnea Study** no. 640 for more information:
   • Setup
     o Oxygenate the patient with 100% FiO2 for 10 minutes. Ensure SpO2 is >95%.
     o Adjust ventilator to achieve normocarbia, as determined by ABG (PaCO2 35-45 mm Hg)
   • Perform the test
     o Disconnect from the ventilator
     o Provide 6 L/min of oxygen via a suction catheter advanced to the level of the carina
     o Watch closely for respiratory effort. If respiratory effort is confirmed the test should be discontinued.
     o Draw an arterial blood gas at 10 minutes
     o Reconnect the patient to the ventilator
   • Determine test results
     o The apnea test confirms absence of brainstem function when there is no observable respiratory effort despite PaCO2 ≥ 60 mm Hg or a PaCO2 increase >20 mm Hg from baseline OR when the test has to be aborted due to patient instability (SBP <80 mmHg, SpO2 <90%, or life-threatening cardiac arrhythmias)

3. **Confirmatory testing**
A valid, complete clinical examination performed by two physicians with a second examination occurring at least 6 hours after the first as outlined above is sufficient to diagnose brain death. However, sometimes prerequisites for clinical testing cannot be met. For example, in the setting of sedative medications or paralytics, when an apnea test cannot be performed due to persistently high
CO₂, and/or in the setting of persistent metabolic derangements that can occur in the setting of liver or kidney failure.

*When performed after the first set of clinical exams confirmatory testing negates the need for a second set of clinical exams.*

The recommended confirmatory test is radioisotope flow study. This is definitive in the face of barbiturates & other conditions mimicking brain death (see appendix below). Brain death is confirmed in the absence of blood flow to the brain.

CT angiogram is another promising technology but requires additional research. Other confirmatory studies include EEG, brainstem evoked potentials, transcranial Doppler, 4-vessel arteriogram, and PET scan. We do not recommend their use.

4. **Time of Death:** Document time of death including PaCO₂ level and time of confirmatory test when applicable. The OFFICIAL time of death is the time an ABG is drawn following apnea testing or, when a confirmatory test is used, the time that study was completed (not read). The eICU also collects time of CARDIAC standstill. This is used by Carolina Donor Services for non-heart-beating donations (has no legal meaning).

5. **Other notifications**
   - Notify Carolina Donor Services when initiating brain death evaluation (1-800-252-2672). Typically, the eICU (0-0625) will assist with this.
   - Providers may not discuss organ donation unless they have completed the required training
   - All trauma deaths are reported to medical examiner. Typically, the eICU (0-0625) will assist with this. The medical examiner is responsible for completing the death certificate.

**APPENDIX**

*Spinal/peripheral nerve mediated reflexes*

Movements originating from the spinal cord or peripheral nerve may occur in brain death. These movements occur in up to ¾ of brain-dead patients and may be triggered by tactile stimuli or occur spontaneously. Examples include:

- Triple flexion response with flexion at the hip, knee, and foot when testing for Babinski sign
- Upper limb pronation extension reflex
- Widespread fasciculations of the trunk and extremity
- Finger flexion
- Semirhythmic contractions of facial muscles
- Tonic, whole body flexion, including the neck, arms, and trunk. Often called the "Lazarus sign."

*Conditions mimicking brain death*

- Locked-in syndrome
- Neuromuscular paralysis, e.g. severe Guillain-Barre
- Hypothermia
- Drug intoxication

*Ordinary and Accepted Standards of Medical Practice*

  - Unreceptive & unresponsive

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Printed copies are for reference only. Please refer to the electronic copy for the latest version.
o No movements or breathing
o No reflexes
o Flat EEG (confirmatory)
o All repeated 24 hours later (arbitrarily selected)
o MUST exclude hypothermia (32.2°F) & CNS depressants
o SUGGEST consultation with 1 or more physicians
o SUGGEST declaration be done by physicians NOT involved in the transplantation of organs

  o Coma with cerebral unresponsivity
  o Apnea
  o Dilated pupils
  o Absent cephalic reflexes (pupillary light response, oculocephalic or doll’s eyes, oculovestibular or cold caloric, corneal reflex, cough and gag)
  o Spinal reflexes may persist after brain death
  o Electroencephalogram silence
  o False negative EEG with drug intoxication, cardiac disease, cerebral trauma, hypothermia & encephalitis
  o MUST exclude hypothermia (32.2°F), CNS depressants, cardiovascular shock & remedial primary disorder
  o RECOMMEND confirmatory test assess cerebral blood flow

  o No cases of recovery after 6 hrs of cessation & confirmatory test
  o Recommend 12 hrs if no confirmatory test (24 hrs for anoxic brain injury)
  o Apnea Study (see WakeMed policy No. 640)
  o Must document a pH2 > 60 mm Hg

- AAN guidelines/checklist