Purpose

The accurate and efficient determination of death by neurological criteria (DNC; also called brain death) is important for the finality of the diagnosis, the needs of family members to grieve and make final arrangements, and to procure organs and tissues for transplantation. This procedure outlines the critical assessments needed for determining DNC.

Training for Declaration of Death by Neurological Criteria

All physicians who participate in the declaration of DNC must complete competency training prior to evaluating patients for DNC. Training and evaluation of competence for DNC shall be determined by the individual hospitals. Competency must be certified at least every five (5) years for staff and every two (2) years for residents. It is not required by the CCHS that the physician have specific neurological, neurosurgical or critical care training to become competent.

An online training course administered by the Continuing Online Medical Education Training (COMET) program which outlines the accepted medical practice for the declaration of DNC is available to physicians who practice in the CCHS. CCHS hospitals may choose to use this training to ensure competency in the administration of DNC evaluation.

Procedure

A declaration of death by neurological criteria, just as a declaration of death by cardiopulmonary arrest, is a diagnosis made by a physician. Although there is a standard procedure to determine DNC, patient circumstances may make the performance of the exam challenging. It is the responsibility of the administering physician to ensure that an adequate evaluation is completed to make the diagnosis of death. It is the CCHS policy that two consistent examinations either by two independent, trained physicians or by one independent, trained physician separated in time are required.

An assessment of cerebral and brain stem function is essential, including an assessment of spontaneous respiration (an apnea test). This assessment should include two separate examinations. One of the two examinations must be conducted by a physician with staff privileges (not a trainee).

The clinical guidelines for this assessment are as follows:

A. Absence of Cerebral Function
Patients must be in a coma to initiate the examination. Clinical testing must reveal no evidence of cerebral function. Patients must be without any type of response to verbal or painful stimuli. All potential causes of coma must be reasonably ruled out including hypothermia, drug intoxication, hypotension, neuromuscular blockade, and sedating medicines. The period of observation required to confirm that neurological criteria for death have been met will vary according to the specific clinical circumstances. A longer period is recommended when the mechanism of coma is not known or the potential for recovery is uncertain. Spinal reflexes and various spontaneous movements may persist in patients who meet neurological criteria for death.

### B. Absence of Brain Stem Function

Clinical tests must also confirm the absence of brain stem reflexes. Typical tests performed include pupillary size and reactivity, cold caloric responses, corneal, oculovestibular, gag, and cough reflexes.

### Determination of DNC

#### Clinical Examination for Diagnosis of DNC

A. DNC is the absence of clinical brain function. When the proximate cause is known and demonstrably irreversible, a clinical examination is sufficient to make the diagnosis of DNC. If the proximate cause is unclear, repeat testing or ancillary testing may be necessary to determine irreversibility.

To declare a patient DNC, the following must be present and documented in the patient's medical record (see below for Documentation):

1. Clinical evidence of an acute Central Nervous System catastrophe that is compatible with the clinical diagnosis of DNC.
2. Exclusion of complicating medical conditions that may confound clinical assessment (such as severe electrolyte, acid-based, or endocrine disturbance).
3. No evidence of drug intoxication or poisoning.
4. Core Temperature > 36°C (97 °F).
5. Mean Arterial Pressure (MAP) of at least 60 mmHg (may be on inotropes/pressors).

B. The three cardinal findings in brain death are coma, absence of brainstem reflexes, and apnea (See Apnea Test section).

1. Coma – no cerebral motor response to pain both in a central location and in the extremities (for example, nail-bed pressure is an example of a peripheral stimulus, and a vigorous sternal rub is an example of central pressure).
2. Absence of brainstem reflexes
   a. Pupils
      - No response to bright light.
   b. Ocular movement
      - No oculocephalic reflex (testing only when no fracture or instability of the cervical spine is apparent).
      - No deviation of the eyes to irrigation in each ear with ice cold water.
      - No corneal reflex.
   c. Pharyngeal and tracheal reflexes (gag reflex)
      - No response after stimulation of the posterior pharynx.
      - No cough response to bronchial suctioning.

### Confounding Conditions for the Diagnosis of DNC
The following conditions may interfere with the clinical diagnosis of DNC, so that the diagnosis cannot be made with certainty on clinical grounds alone. Repeat testing after the confounding issue resolves or ancillary testing is necessary to complete the evaluation. The following findings/conditions may warrant additional assessment:

A. Severe facial trauma
B. Pre-existing pupillary abnormalities
C. Toxic levels of any sedative drugs, aminoglycosides, tricyclic antidepressants, anticholinergics, antiepileptic drugs, chemotherapeutic agents, or neuromuscular blocking agents
D. Hypothermia
E. Hypotension

There are a number of movements that can occur in patients without brain function that do not invalidate the clinical examination. They are generated from spinal reflexes that have no cerebral component.

The following findings or conditions should be assessed; if there is concern about the nature of these movements, a neurological or neurosurgical consultation is recommended.

A. Spontaneous slow or jerking movements of limbs other than pathologic flexion or extension response. In addition, rising of both knees is a typical spinal reflex. These movements should not be goal directed or a response to verbal command.
B. Chest and shoulder movements including elevation and adduction, and back arching.
C. Sweating, blushing, tachycardia.
D. Normal blood pressure without pharmacologic support or sudden increase in blood pressure.
E. Absence of diabetes insipidus (DI).
F. Deep tendon reflexes; superficial abdominal reflexes; triple flexion response.

**Apnea Test**
The apnea test is completed to ensure that a patient who appears not to be breathing spontaneously will NOT begin to breathe when given a maximal stimulus (a superphysiologic partial pressure of CO2 [PaCO2]).

**Requirements:**
A. Written physician order for an apnea test
B. Telemetry monitoring
C. Continuous pulse oximetry
D. Core Temperature > 36°C (97 °F)

**Procedure (to be completed by the Respiratory Therapist with a physician's assistance):**
A. Assemble the following equipment:
   1. Tracheal continual connected to a 6 Lpm oxygen source
   2. Manual Resuscitator with appropriate patient interface
   3. Arterial blood gas kits (2 or 3)
B. Pre-oxygenate the patient on the ventilator with 100% O2 for a minimum of 10 minutes.
C. Draw an arterial blood gas sample to determine if start criteria are met.
   1. PaCO2 between 35 and 45 mmHg
   2. Arterial pH 7.35 to 7.45
   3. If patient has not reached these criteria prior to starting apnea test,
      a. Make ventilator changes needed to achieve a pH 7.35 to 7.45
      b. Make ventilator changes needed to achieve a PaCO2 of 35 – 45 mmHg
D. Disconnect the patient from the mechanical ventilator.*
   1. Insert tracheal catheter into the tracheostomy tube
   2. Administer oxygen at 6 Lpm
E. Observe for spontaneous respirations.*
1. If spontaneous respirations are observed
   a. Reinstitute mechanical ventilation
   b. Document the procedure in the patient's medical record

2. If no spontaneous respirations are observed,*
   a. Draw arterial blood gasses after 10 minutes. Record the ABG results in the medical record.
   b. If the PaCO2 is e 60 mmHg and the pH is d7.30, it may be concluded that the respiratory reflex is absent.
   c. Reinstitute mechanical ventilation
   d. Document procedure in the medical record.

*If hypotension and/or arrhythmias develop, immediately reconnect the patient to the ventilator.

Ancillary Tests
An ancillary test may be attempted for patients in whom clinical testing is consistent with DNC but the mechanism of injury is not clear. Declaration of DNC cannot be completed for a patient for whom complete brain stem evaluation cannot be performed without ancillary testing. Tests may include transcranial Doppler ultrasonography, electroencephalogram (EEG), CT angiography, digital subtraction cerebral angiography, and isotope scintigraphy. Ancillary testing cannot be performed to confirm death in a patient with hypothermia. The patient should be rewarmed and reassessed.

An isoelectric EEG is not mandatory for the determination of DNC, but when used in conjunction with the clinical criteria for DNC, it provides additional evidence in support of DNC. EEG cannot be used as the sole criterion for the diagnosis of DNC.

An ancillary test is mandatory only for patients in whom complete brain stem evaluation (including apnea test) cannot be performed. Ancillary tests may include, but are not limited to, recording evidence of an absence of cortical electrical activity or imaging evidence of sustained arrested intracranial blood flow in the presence of otherwise adequate extra-cranial circulation.

Declaration of Death
After the completion of two consistent examinations by independent, trained physicians, an apnea test and ancillary tests (if appropriate) consistent with DNC, a physician must declare the patient dead and note the date and time of the declaration in the medical record. The time of death is the time the arterial pCO2 reached the target value.

In patients requiring ancillary tests, the time of death is the time of the official reading of the confirmatory test. Upon declaration, the family or legal decision maker should be notified that the patient is deceased and the concept of DNC, if not already discussed, should be explained with appropriate time to answer the family's or decision maker's questions. In addition, prior to testing for declaration of DNC, LifeBanc, the organ procurement organization (OPO) for northeastern Ohio, must be notified.

Documentation
Documentation of DNC will be in the patient's medical record. For EPIC users, the procedure is as follows: Open the doc flow sheet tab on the left side of the inpatient EPIC record and search for DNC documentation (using the search function). In the DNC document, choose first or second examiner then fill in the examination, the apnea test, and ancillary test (if appropriate)*. After the second examiner completes the form, use the field available for date and time of declaration of death. When the EPIC flow sheet is completed, go to the Inpatient Note tab and click on the icon for templates. Search for the DNC template in the search function which will import the information from the flow sheet to populate the note. The physician then amends the note as needed and accepts the note (which completes the declaration of death). A more detailed description of the documentation process is in the COMET training module.

*Only the second examiner will have the option to fill in the apnea and ancillary tests.
Oversight and Responsibility

A. Physicians on staff at Cleveland Clinic Health System hospitals are responsible for completing training for DNC. The supervising medical staff is responsible for ensuring compliance with competence in DNC.
B. DNC trained Medical Staff and resident physicians are responsible for adhering to this procedure and its related policy and for appropriate documentation in the patient's medical record.

Definitions

Death by Neurological Criteria (DNC; also called Brain Death)
Death can result from brain damage that is so severe and extensive that the brain has no function and has no potential for recovery of function. In such cases, spontaneous respiration has irreversibly ceased owing to structural brain damage, but systemic circulation and respiration are still maintained by artificial life-support. Under such circumstances, ventilatory and circulatory support may preserve the peripheral organs for a time.

Policy References
CCHS Policy RI 116 Death by Neurological Criteria Policy

Issuing Office
CCHS Counsel of Medical Executive Committees

Task Force/Committee
Organ Donation Committee
Chair: Dr. Provencio

Ethics Committee

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