
**UNIVERSITY OF ILLINOIS MEDICAL CENTER AT CHICAGO
CLINICAL CARE GUIDELINE**

**DETERMINATION OF NEUROLOGIC DEATH IN
ADULTS AND CHILDREN**

April 2010

**Key Content Expert: Medical Center Ethics Committee in consultation with Chiefs of
Service for Neurology & Neurosurgery**

These systematically developed statements have been created to assist the practitioner in the formulation of health care decisions in specific clinical circumstances. They are not to be construed as an inflexible set of correct procedures or protocols.

In each clinical circumstance the exercise of individual judgment is essential.

Guidelines are based upon statistical averages and opinions of practicing clinicians. Variation from these guidelines does not constitute improper care or improper professional judgment. Evaluation of these variations requires detailed analysis of the facts and circumstances surrounding the individual patient's care.

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NO.: G-15.2
DATE: April 2010

SUBJECT: Determination of Neurologic Death in Adults and Children

OBJECTIVE

To recognize that the physical condition of some patients requires specific clinical measures to determine that death by neurologic criteria has occurred and that these measures involve explicit clinical data.

DEFINITIONS

For the purpose of this policy, the following definitions apply:

The **responsible physician** is the Attending Physician in charge of the case. Any decisions made by a Resident Physician should be made with the specific concurrence of the Attending Physician or the Chief of Service.

Death by neurological criteria constitutes the irreversible cessation of all functions of the brain, as measured by specific evaluations and when certain complicating conditions have been excluded (see below).

POSITION STATEMENTS

In keeping with established legal and professional standards, UIMC recognizes the irreversible cessation of all brain function as its standard for the determination of death. The Medical Center staff shall apply stringent criteria to determine that neurologic death has occurred.

See addendum for specific determination of neurologic death in children procedure.

PROCEDURE

- I. The diagnosis of possible neurologic death should be considered when a patient is on a ventilator and has:
 - A. Coma with absent cerebral motor response to pain; and
 - B. No brainstem reflexes including absence of ventilatory drive.

When such a patient is identified, a physician having expertise in the assessment for determining neurologic death will have the final responsibility for the determination of neurologic death and for the notification of the responsible physician if s/he is not the responsible physician.

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II. The determination of neurologic death can be made when the following criteria are met:

NOTE: Exclude the complicating conditions listed below. In clear cases of irreversible cessation of brain function from clearly definable etiologies, the diagnosis of neurologic death can be made on clinical examination alone. The clinical examination findings demonstrating coma and absent brainstem reflexes must be confirmed by a second neurological examination at least 6 hours after the first neurological examination and corroborated by an apnea test. Any initial clinical examination finding which is not clear and definite should be repeated. Ancillary testing such as conventional cerebral angiography, transcranial Doppler ultrasonography, electroencephalography, and nuclear blood flow study may be employed and is required in cases in which a complete neurological examination cannot be performed, the etiology is unclear, a complicating factor such as medication or confounding medical condition exists, or an apnea test cannot be safely completed.

- A. A definable neurological insult is established by history or neuroimaging and is compatible with the clinical diagnosis of neurologic death
- B. Complicating conditions:
 - 1. Neuromuscular blocking agent or other pharmacologic agent/toxin that may confound examination.
 - 2. Hypothermia (core temperature $\geq 32^{\circ}\text{C}$).
 - 3. Complicating medical condition that may confound clinical assessment.
- C. Clinical examination criteria:
 - 1. Coma with absent cerebral motor response to nail bed pressure and supra-orbital pressure.
 - 2. Absence of brainstem reflexes.
 - a. Absent pupillary response to bright light.
 - b. Absent oculocephalic reflexes in patients without suspected injury or instability of the cervical spine.
 - c. Absent oculovestibular reflexes (ice caloric test) as defined by no deviation of the eyes to irrigation in each ear of 50 ml of cold water (allow one {1} minute after injection for movement to occur, and at least five {5} minutes between testing on each side) with the head elevated to 30 degrees.
 - d. Absent corneal reflexes
 - e. Absent jaw reflex
 - f. Absent facial grimace to pressure on nail bed, supra-orbital notch and temporomandibular joint.
 - g. Absent pharyngeal reflexes (cough to deep suction and gag reflex).
 - 3. Apnea confirmed as follows:
 - a. Prerequisites.
 - i. Core temperature $\geq 36.5^{\circ}\text{C}$.
 - ii. Systolic blood pressure > 90 mmHg.
 - iii. Normal PO_2 (may be in the presence of supplemental oxygen).
 - iv. $\text{PCO}_2 > 35$ mm Hg

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- b. Connect a pulse oximeter.
 - c. Pre-oxygenate with 100% O₂ at least 10 minutes and discontinue ventilator support.
 - d. Supplemental oxygen may be administered through a cannula inserted through the endotracheal tube and placed at the level of the carina.
 - e. Visually monitor for chest wall movement.
 - f. Draw ABG after approximately 8-15 minutes.
 - g. If respiratory movements are absent and arterial PCO₂ is > 60 mmHg the apnea test supports the diagnosis of neurologic death. If patient's baseline PCO₂ is greater than or equal to 40mm Hg, then the PCO₂ must increase by 20mm Hg before test is deemed positive.
 - h. If respiratory movements are observed the apnea test does not support the clinical diagnosis of brain death.
 - i. If the PCO₂ is < 60 mm Hg or the PCO₂ is < 20 mm Hg over baseline PCO₂ that is greater than or equal to 40 mm Hg, the result is indeterminate and the test should be repeated or an ancillary test should be considered.
 - j. Terminate the test and reconnect the ventilator immediately if spontaneous respiratory movements or signs of hemodynamic instability (e.g., hypotension, hypoxemia, arrhythmia, etc.) are observed.
- III. Clinical Observations Compatible with the diagnosis of neurologic death. These manifestations are occasionally seen and should not be misinterpreted as evidence for brain stem function.
- A. Spontaneous "spinal" movements of limbs (not to be confused with pathologic flexion or extension response).
 - B. Respiratory-like movements (shoulder elevation and adduction, back arching, intercostal expansion without significant tidal volumes).
 - C. Sweating, blushing, tachycardia.
 - D. Normal blood pressure without pharmacological support.
 - E. Absence of diabetes insipidus (normal osmolar control mechanism).
 - F. Deep tendon reflexes; triple flexion response.
 - G. Babinski's reflex.
- IV. Pronouncement of Death
- A. The pronouncement of death shall be subsequent to the criteria for neurological death having been met.
 - B. The time of death shall be established as that time when the irreversible cessation of all brain function was determined.
 - C. After the patient is declared dead, life support mechanisms should be removed unless the patient is either an organ donor or carrying a viable fetus.
 - D. The body is handled as any other deceased.

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Addendum

Determination of Neurologic Death in Children

Reference

University of Illinois Medical Center at Chicago,
Medical Center Management Policy and Procedure Manual,
[RI 4.06 Organ and Tissue Donation](#)

EFM Widjeks. "Determining Brain Death in Adults." *Neurology* 1995; 45: 1003-1011

Rescission

May 2006
November 2004
September 2003
September 2001
October 1998
December 1995

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ADDENDUM: Determination of Neurologic Death in Children

The guidelines for Determination of Neurologic Death in Children are as for the Determination of Neurologic Death in Adults, with the following **EXCEPTIONS**:

1. Procedure II, NOTE section (above)

Specific observation periods and ancillary testing are required for infants and young children of specific ages. These requirements are:

(1) 7 days to 2 months

Two examinations and two EEGs 48 hours apart. Both EEGs must show electrocerebral silence

(2) 2 months to 1 year

Two examinations and two EEGs 24 hours apart OR

One examination and an initial EEG showing electrocerebral silence AND a radionuclide angiogram showing no cerebral blood flow. The two studies should be 24 hours apart.

(3) More than 1 year

Two examinations 12 hours apart, using the guidelines for determination of Neurologic Death Section II. A prolonged observation period of 24 hours, or ancillary testing such as EEG and isotope angiography may be employed in cases in which the etiology is unclear, a complicating factor such as medication or confounding medical condition exists, or an apnea test cannot be safely completed.

(4) Age 16 years and older

The guidelines for Neurologic Death Section II apply without restriction.

(5) No criteria for brain death have been established for the first seven days of life or for premature infants

* EEGs are to be completed only after the Phenobarbital level is 5 or less, the phenytoin level is 2 or less and midazolam has been discontinued for 48 hours or more.

2. Criterion Procedure II, C, 2, c

The volume of cold water used to irrigate the ear should be proportional to the size of the child.

3. Criterion Procedure II, C, 2, e

In addition, absent sucking and rooting reflexes.

4. Criterion Procedure II, C, 3, a, ii

The child must not be hypotensive for age.

5. Criterion Procedure II, C, 3, e

Draw the ABG after 5 - 8 minutes, then restart ventilation with 100% O₂.

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6. Criterion Procedure II, C, 3, h

If the PCO_2 is less than 60 mmHg or the PCO_2 is less than 20 mmHg over baseline normal PCO_2 , the result is indeterminate and should be repeated for a longer interval.

(Procedure II, C, 3, j has been removed from the criteria.)

The criteria are those of the 1987 Ad Hoc Task Force Committee on Brain Death, representing the American Academy of Neurology, American Academy of Pediatrics, American Bar Association, American Neurological Association, Child Neurology Society and the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS).

Task Force for the Determination of Brain Death in Children: Guidelines for the determination of brain death in children. Task Force for the Determination of Brain Death in Children. Archives of Neurology 1987 Jun; 44(6): 587-8