LOS ANGELES COUNTY DEPARTMENT OF HEALTH SERVICES
HARBOR-UCLA MEDICAL CENTER

SUBJECT: GUIDELINES FOR THE ASSESSMENT OF BRAIN DEATH **POLICY NO.** 315

CATEGORY: Provision of Care	**EFFECTIVE DATE:** 1/75
POLICY CONTACT: Susan Shaw Huang, MD	**UPDATE/REVISION DATE:** 8/22
REVIEWED BY COMMITTEE(S):	

PURPOSE:
To establish procedures for the determination of brain death in infants, children, and adults.

POLICY:
Harbor-UCLA Medical Center follows these criteria for the determination of brain death in infants, children, and adults in accordance with the following California Health and Safety Codes:

"7180. (a) An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. A determination of death must be made in accordance with accepted medical standards.

7181. When an individual is pronounced dead by determining that the individual has sustained irreversible cessation of all functions of the entire brain, including the brain stem, there shall be independent confirmation by another physician.

7182. When a part of the donor is used for direct transplantation pursuant to the Uniform Anatomical Gift Act (Chapter 3.5 (commencing with Section 7150)) and the death of the donor is determined by determining that the individual has suffered irreversible cessation of all functions of the entire brain, including the brain stem, there shall be independent confirmation of the death by another physician."

PROCEDURE:
Harbor-UCLA Medical Center has established these criteria for the determination of brain death at the Medical Center. The Checklist for the Determination of Brain Death (Appendix 1) may be utilized to assure that all of the appropriate steps have been followed.

A. PATIENT ASSESSMENT

REVISED: 1979, 1983, 1986, 1987, 1997, 10/01, 2/05, 3/09, 7/10, 1/11, 8/22
REVIEWED: 6/86, 9/89, 10/92, 2/96, 1/97, 10/01, 5/14, 9/17, 8/22

APPROVED BY:

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Brain death is a clinical diagnosis based on a history of irreversible brain injury and on careful physical examination. California law requires independent, written certification by two licensed physicians familiar with the procedures of brain death determination, based on personal examination of the patient. The brain death assessment and documentation should only be performed when requested by the attending of record. At Harbor-UCLA, one of these assessments must be from a licensed physician and surgeon in the State of California in the Division of Neurosurgery or from either the Department of Neurology or Division of Pediatric Neurology who has been determined competent to perform this examination by the supervising attending physician. If any of the examinations are performed by a trainee, the assessment must be cosigned by the supervising attending physician.
The following elements are essential in the determination of brain death:

1. Establish the irreversible and proximate cause of coma by history, examination, and appropriate laboratory tests. Exclude the presence of a central nervous system (CNS) depressant drug by calculating clearance at 5 half-lives and/or serum drug level if available. TTM may prolong the clearance of medications. Exam should not be performed <24 hours post cardiac arrest. Exclude effect of neuromuscular blocking agent using train of four twitches if needed. Exclude severe metabolic derangement that may affect the clinical exam.
2. Achieve near-normal body core temperature. A value ≥ 36°C is required for adults. A value ≥ 35°C is required for children.
3. Achieve adequate systolic blood pressure (SBP) or mean arterial pressure (MAP). For adults, a value ≥ SBP 100 mm Hg or ≥ MAP ≥60mmHg is required. For children, systolic blood pressure should not be less than the 5th percentile of the age-appropriate norm.
4. Establish absence of any form of responsiveness, awareness, or purposeful movement. Examples include localizing limb movements, eye movement, grimacing, and eye opening to noxious stimuli. If present, these are not consistent with a diagnosis of brain death.
5. Clinical Brain Death assessment
    a. Demonstrate absence of brainstem reflexes:
        i. Absent facial movement
        ii. Absent pupillary reflexes to bright light or pupillometer
        iii. Absent corneal reflexes (Tactile stimulation with gauze or cotton swap on lateral portion of iris)
        iv. Absent eye movements to oculocephalic reflex (Doll's Eye). Oculocephalic reflex omitted if C-spine injury and ancillary testing is advised.
        v. Absent eye movements to oculovestibular reflex (ice water caloric) testing
            i. Confirm intact tympanic membrane with otoscope.
            ii. Instill minimum 30ml ice water into ear for at least 60 seconds. Patient should be at 30° elevation with neutral head position.
            iii. Observe for 60 seconds for eye movement, and wait 5 minutes before testing contralateral reflex.
        vi. Absent cough reflex to tracheobronchial suctioning via suction catheter in endotracheal tube
        vii. Absent gag reflexes to stimulation of posterior pharyngeal wall with tongue depressor or suction catheter
    b. Apply noxious stimulation at minimum in one location in the face (supraorbital notch, condyle of TMJ), and two locations in each limb (distal and proximal). Spinal mediated reflexes may be present.

6. Establish absence of spontaneous respiration by apnea test. Must be performed with one exam for adult brain death determination, and two exams for pediatric brain death determination.
    1. Test must be conducted off mechanical ventilatory support. Apnea testing in adults should be performed as part of the second brain death determination exam when able to avoid patient instability that may preclude the second clinical exam.
    2. An immediate pre-test arterial blood gas and post-test arterial blood gas are required. Arterial line access is preferred to ensure timing of blood gases. Baseline target before proceeding is PCO2 35-45. Adjust respiratory rate to achieve CO2 baseline if able.
    3. Preoxygenate and maintain the patient on 100% F_iO_2 throughout the testing period.
        - Oxygen may be administered via catheter in ETT not to exceed 6 LPM, or otherwise per policy and provider guidance.
    4. Check iSTAT and/or lab ABG at 10 mins, and up to 15 mins if CO2 is not yet at threshold and patient is tolerating apnea. Waveform capnography may be useful to guide timing of ABG during apnea test but cannot be used to confirm apnea.
    5. Test supports brain death if pCO2 reaches ≥60 mm Hg and/or increases ≥ 20 mm Hg over normal pre-test value (for those with a condition causing tolerance of hypercapnia).
    6. Test should be aborted if systolic blood pressure significantly decreases, if spontaneous respirations are observed, if unstable cardiac arrhythmia develops, or if oxygen saturation declines to <85%. Send ABG if apnea test is aborted early as it is still possible to reach threshold in a shorter time frame.
    7. If the apnea test cannot be completed or performed, or if other confounders exclude a complete clinical exam, ancillary testing is required.

B. ANCILLARY TESTING

Ancillary tests may also be performed but they do not substitute for a full examination by an experienced physician. These tests may be used to support the diagnosis of brain death, particularly when an apnea test cannot be performed, there is inability to perform any components of the clinical exam including, but not limited to, unstable cervical injury or facial/eye trauma, there is uncertainty regarding spinal mediated reflexive movements, or there is coincident metabolic derangement that cannot be fully corrected. Strict technical criteria specific to the determination of brain death must be applied for each test. Ancillary tests include:

1. Electroencephalography (EEG)
    i. EEG should demonstrate a lack of reactivity to noxious stimulation. Sensitivity should be increased to 2μV for 30 minutes, a high-frequency filter set at 30Hz or greater, and a low-frequency setting not above 1 Hz.
2. Radionuclide cerebral blood flow study
3. Conventional 4-vessel cerebral angiography
4. Transcranial doppler ultrasonography (adults only)

C. BRAIN DEATH IN CHILDREN

The patient assessment for the determination of brain death in infants and children is the same as that for adults. Two examinations are required, including apnea testing. However, each examination must be separated by an observation period as described below. Examinations should be performed by different physicians, although apnea testing may be performed by the same physician. Each exam must remain consistent with brain death. Brain death should not be determined until 37 weeks gestational age.

1. For term newborns (37 weeks gestational age) to 30 days of age, the observation period is 24 hours.
2. For infants and children 30 days of age or older, the observation period is 12 hours.

3. When ancillary studies are used, the observation interval can be shortened and the second examination can be performed at any time once the ancillary test confirms brain death.
4. Include rooting and sucking reflexes when assessing infants.

D. FAMILY NOTIFICATION

Before or during the process of diagnosing brain death, the patient's primary attending physician or his/her physician designee must notify the family of the implications of the diagnosis, describing the discontinuation of organ support. Verbal notification shall be supplemented with a written document given to the family by a practitioner on the primary healthcare team (Appendices 2 & 3). Questions should be answered and the family should be assisted in obtaining available support services. At the time of pronouncement, the family should be immediately notified and, whenever possible, this should precede the withdrawal of measures to artificially support cardiovascular, respiratory and other organ function. Cardiopulmonary support may be continued for no longer than 12 hours at family request to allow the family time to gather at the bedside. During this period, only previously-ordered cardiopulmonary support is mandated and no other medical intervention is required.

If the patient's legally recognized health care decision-maker or family voices specific religious or cultural concerns surrounding the issue of brain death, there should be a reasonable effort to accommodate these concerns.

Families who desire an outside opinion may obtain one from a qualified California-licensed neurologist or neurosurgeon, provided that such a physician provides timely documentation of his/her credentials to obtain temporary medical staff privileges in accordance with the bylaws of the Professional Staff Association. Any expense for such a consultation must be borne by the family and the consultation must be completed within 24 hours of the first certification of brain death by a hospital-based physician.

E. DOCUMENTATION

Brain death is pronounced at the time of the second brain death assessment (when blood gas confirms apnea) or at the time of interpretation of a confirmatory ancillary test, if one was performed. All exams and tests specific to the diagnosis of brain death must be documented in the medical record, including those providing independent confirmation by the two physicians. In addition, a note acknowledging brain death should be written by the Attending physician on the primary team caring for the patient.
Time of death: (Whichever comes last)

- When the 2 brain death exams are completed, signed by a licensed physician, and are consistent with brain death
- AND at time of PCO2 results confirming threshold met during apnea test
- OR at time of completion and interpretation of ancillary test result, when required

F. ORGAN DONATION

A brain-dead patient may in some circumstances provide viable organs to a living recipient. Physicians involved in care of the patient should not initiate discussion of the potential for organ donation with families and should defer these discussions to the organ procurement organization (OPO). However, physicians may alert families that the OPO may be contacting them. If brain death is imminent or has been declared, the physician in charge of the patient's care or his/her designee must notify the OPO (see Hospital Policy No. 316). In addition, neither the physician making the determination of death nor the physician making the independent confirmation shall participate in the procedures for removing or transplanting organs or tissue.

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REFERENCE:
Hospital Policy No. 316 - Tissue and Organ Donations

Reviewed and approved by:
Medical Executive Committee 08/2022

Beverley A. Petrie, M.D.
President, Professional Staff Association

APPENDIX 1
Checklist for Determination of Brain Death in Adults

Prerequisites (All criteria must be met to proceed)

- ☐ Irreversible coma with identifiable cause
- ☐ CNS depressant drug effect absent (if indicated, do toxicology screen)
- ☐ No evidence of residual paralytic agent (nerve stimulation if muscle relaxants used)
- ☐ No severe acid-base, electrolyte, or endocrine abnormality
- ☐ Core body temperature ≥ 36°C
- ☐ Systolic blood pressure (SBP) ≥ 100 mmHg or Mean arterial pressure (MAP) ≥ 60 mmHg
- ☐ No spontaneous respirations evident
- ☐ Notification letter provided to family

Clinical Examination

- ☐ Pupils non-reactive to bright light or pupillometer
- ☐ Corneal reflex absent
- Oculocephalic reflex ☐ absent ☐ deferred due to c-spine injury
- ☐ Oculovestibular reflex absent to ice water caloric testing
- ☐ No facial movement to noxious stimuli
- ☐ Gag reflex absent to posterior pharyngeal stimulation
- ☐ Cough reflex absent to bronchial suctioning
- ☐ Motor responses absent to noxious stimuli in all 4 limbs (spinal reflexes permissible)

Apnea Testing
Prerequisites:

- ☐ Patient remained hemodynamically stable with SBP>100 or MAP>60
- ☐ Ventilator adjusted to provide baseline normocarbia (pCO_2 35-45 mm Hg)
- ☐ Patient preoxygenated with 100% FiO_2
- ☐ Provided 100% FiO_2 for entire test (per Respiratory Therapy protocol) and maintain saturation >85%
- ☐ Disconnect from ventilatory support
- ☐ Observe for respiratory effort
- ☐ Draw arterial blood gas at 8-10 minutes, can extend to 15 mins if tolerated, and reconnect patient to ventilator

APPENDIX 2

Harbor-UCLA Medical Center
Family Letter (adult)

To The Family of _____,

The doctors at Harbor-UCLA Medical Center have found out that your loved one's brain is very badly damaged. The doctors are getting ready to do tests to find out if the brain damage affects the whole brain and will last forever. This is called brain death. Brain death means your loved one will never be able to breathe or know who you are.

The law says that brain death is the same as the heart stopping and means that your loved one has died. Machines and medicines used to support the body, including the breathing machine, are stopped However, some things may be continued for a short time after death so that family members can come to the patient's bedside, but this is done only if you ask for it.

The hospital has social workers that can meet with your family to help you. If you have not talked to a social worker, ask your nurse or doctor to call one. You can also make an appointment by calling (424) 306-4420 in the daytime during the week. We also have Religious Services in our hospital. Please let the nurses know if you want to have a spiritual person meet with you. Also, if you have any special religious or cultural needs, please tell the social worker or spiritual leader so they can help us try to meet your needs.

APÉNDICE 2

Harbor-UCLA Medical Center
Carta a la Familia (adulto)

A La Familia de_____,

Los doctores del Centro Médico Harbor-UCLA han encontrado el cerebro de su ser querido con un deterioro muy severo. Los doctores van a realizar unas pruebas para determinar si el daño cerebral afecta todo el cerebro y saber si durará por siempre. Esto se conoce como muerte cerebral. Se entiende por muerte cerebral que su ser querido ya no podrá volver a respirar o a reconocerle.

La ley establece que una muerte cerebral es equivalente a decir que el corazón se ha detenido y significa que su ser querido ha fallecido. Los aparatos y medicamentos que se usaban para mantener su cuerpo, incluyendo la máquina de respiración artificial, se han detenido. Sin embargo, algunos mecanismos pueden continuar funcionando por un breve periodo después del deceso a fin de que los familiares puedan acercarse a la cama del paciente, aunque, esto sólo se hará si usted lo pide.

Este hospital cuenta con trabajadores sociales que se pueden reunir con usted y sus familiares para brindarles ayuda. Si todavía no ha hablado con un trabajador social, pídale a su enfermera o a su doctor que le pongan en contacto con uno de ellos. Usted también puede llamar para pedir una cita al (424) 306-4420 en horario de oficina entre semana. En este hospital también ofrecemos Servicios Religiosos. Le pedimos que avise a las enfermeras si desea la visita de una persona de oficio espiritual. Asimismo, si tiene alguna preferencia especial de tipo religioso o cultural, le pedimos se lo diga al trabajador social o al líder espiritual para que intentemos satisfacer sus necesidades.

APPENDIX 3

Harbor-UCLA Medical Center
Family Letter (child)

To The Family of _____,

The doctors at Harbor-UCLA Medical Center have found out that your child's brain is very badly damaged. The doctors are getting ready to do tests to find out if the brain damage affects the whole brain and will last forever. This is called brain death. Brain death means your child will never be able to breathe or know who you are.

The law says that brain death is the same as the heart stopping and means that your child has died. Machines and medicines used to support the body, including the breathing machine, are stopped. However, some things may be continued after death for a short time so that family members can come to your child's bedside, but this is done only if you ask for it.

The hospital has social workers that can meet with your family to help you. If you have not talked to a social worker, ask your nurse or doctor to call one. You can also make an appointment by calling (424) 306-4420 in the daytime during the week. We also have Religious Services in our hospital. Please let the nurses know if you want to have a spiritual person meet with you. Also, if you have any special religious or cultural needs, please tell the social worker or spiritual leader so they can help us try to meet your needs.

APÉNDICE 3

Harbor-UCLA Medical Center
Carta a la Familia (Niño)

A La Familia de_____,

Los doctores del Centro Médico Harbor-UCLA han encontrado el cerebro de su niño con un daño muy severo. Los doctores van a realizar unas pruebas para determinar si este daño cerebral afecta todo el cerebro y saber si durará por siempre. Esto se conoce como muerte cerebral. Se entiende por muerte cerebral que su ser querido ya no podrá volver a respirar o a reconocerle.

La ley establece que una muerte cerebral es equivalente a decir que el corazón se ha detenido y significa que su niño ha fallecido. Los aparatos y medicamentos que se usaban para dar mantenimiento a su cuerpo, incluyendo la máquina de respiración artificial, se han detenido. Sin embargo, algunos mecanismos se continuarán administrando después del deceso por un breve periodo para que sus familiares puedan acercarse a la cama de su niño, aunque, esto sólo se hará si usted lo pide.

Este hospital cuenta con trabajadores sociales que pueden reunirse con usted y sus familiares para brindarles ayuda. Si todavía no ha hablado con un trabajador social, pídale a su enfermera o a su doctor que le pongan en contacto con uno de ellos. Usted también puede pedir una cita llamando al (424) 306-4420 en horario de oficina entre semana. En este hospital también ofrecemos Servicios Religiosos. Le pedimos que avise a las enfermeras si desea la visita de una persona de oficio espiritual. Asimismo, si tiene alguna preferencia especial de tipo religioso o cultural, le pedimos se lo diga al trabajador social o al líder espiritual para que intentemos satisfacer sus necesidades.