



Label Area

**CERTIFICATION OF DEATH BY
NEUROLOGIC CRITERIA (CRITERIA FORM)
Patient 18 Years of Age or Older**

Two in-hospital clinical examinations must be performed. The clinical examinations must be separated in time by at least 6 hours. The examinations may be performed by the same physician or by different physicians (see Table 1, page 2 for physicians eligible to perform examinations). For patients who had a cardiac arrest who were NOT treated with therapeutic temperature management, an observation period of at least 24 hours after return of spontaneous circulation must elapse prior to initiation of brain death determination. For patients who have had a cardiac arrest who WERE treated with therapeutic temperature management, an observation period of at least 24 hours after rewarming to 37°C must elapse prior to initiation of brain death determination. The brain injury must be one that, in the judgement of the examiner, is sufficient to account for irreversible loss of whole brain function, confounding factors must be excluded, and the clinical examinations must demonstrate no evidence of function of the entire brain. A confirmatory test should be performed only when clinically indicated according to PPMC policy. The results of the clinical examinations, apnea test, and the results of any confirmatory tests performed must be documented.

A. An Appropriate Mechanism Exists for Permanent Loss of Whole Brain Function

1. Is the cause of the coma known and sufficient to account for irreversible loss of whole brain function? (answer "Yes" or "No") _____
2. If the answer to #1 above is yes, please specify diagnosis _____
3. If the answer to #1 above is no, then do not proceed with brain death determination.

B. For Patient Whose Mechanism of Brain Injury is Cardiac Arrest, an Appropriate Period of Observation Elapsed Prior to the First Clinical Examination

1. For patients who have had a cardiac arrest, an observation period of at least 24 hours after return of spontaneous circulation (in patients NOT treated with targeted temperature management) or 24 hours after rewarming (in patients treated with targeted temperature management) has elapsed _____ (answer "Yes" or "N/A")

C. Confounding Conditions Were Excluded (Answer each of the following "Yes" or "No")

1. Hypothermia is not present _____
 - a. core body temperature must be greater than or equal to 36°C or 96.8°F
2. Drug intoxication has been excluded _____
 - a. toxicology screening, if appropriate
 - b. specific levels of CNS depressants that might complicate the examination are left to clinical judgement
3. Significant hypotension is not present. With or without pressors, SBP is at least 100 mmHg, or for patients on ECMO, MAP is at least 65 mmHg. _____
4. Severe endogenous metabolic (renal, hepatic, electrolyte, endocrine, acid-base, and vitamin) derangements and intoxication have been excluded _____
5. Neuromuscular paralyzing drug effect has been excluded (by history or with a twitch monitor) _____

D. Unresponsiveness Documented (Answer each of the following "Yes" or "No")

- | | 1 st Exam | 2 nd Exam |
|--|----------------------|----------------------|
| 1. Responses to painful stimuli are absent | _____ | _____ |
| 2. Spontaneous movements are absent, aside from spinal reflexes | _____ | _____ |
| Note: Deep tendon reflexes, including stereotypical triple flexor responses in the legs, are compatible with brain death. Purposeful movement or posturing preclude the diagnosis of brain death. | | |
| 3. Locked-in state is excluded (testing of vertical eye movements) | _____ | _____ |

E. Loss of Brain Stem Function Documented (Answer each of the following "Yes" or "No")

- | | | |
|---|-------|-------|
| 1. Pupils are unresponsive to bright light (usually greater than 4 mm) | _____ | _____ |
| 2. Corneal reflexes are absent | _____ | _____ |
| 3. Oculocephalic reflexes are absent (no eye movement with head turning) | _____ | _____ |
| 4. Oculovestibular reflexes are absent (no eye deviation to 50 mL of ice water in each ear canal) | _____ | _____ |
| 5. Gag response to oropharyngeal stimulation is absent | _____ | _____ |
| 6. Cough response to stimulation of the carina is absent | _____ | _____ |



F. Times of Clinical Exams Documented

- | | | |
|------------------------------|----------------------|----------------------|
| | 1 st Exam | 2 nd Exam |
| 1. Date of Clinical Exam | _____ | _____ |
| 2. Time of Clinical Exam | _____ | _____ |
| 3. Examiner's Name (Printed) | _____ | _____ |
| 4. Examiner's Signature | _____ | _____ |

Table 1. PHYSICIANS ELIGIBLE TO PERFORM CLINICAL EXAMINATIONS:

FIRST EXAMINATION	SECOND EXAMINATION
Attending physician with privileges to determine brain death Neurocritical Care fellow Neurology resident, PGY-2 or higher Neurosurgery resident, PGY-2 or higher	Attending physician with privileges to determine brain death Neurocritical Care fellow, year 2 or higher Neurosurgery resident, PGY-7 or higher

G. The Apnea Test (see pages 3 and 4 for the apnea testing procedures)

Date _____ Time _____ Physician Examiner (Print) _____

- a. Initial PaCO₂ (must be 35-45 mmHg) _____
- b. Final PaCO₂ _____

Comments:

1. Apnea test showed no respiratory movements with the necessary CO₂ rise and pH fall? (answer "Yes" or "No") _____
2. Type of apnea test performed (circle one): Off-ventilator / On-ventilator / ECMO

Signature of Physician Present During Apnea Test _____

H. If Required, Confirmatory Test Performed

Perform a confirmatory study when conditions preclude a complete exam (e.g. severe facial injury), the apnea test cannot be performed (e.g. due to cardiopulmonary instability during testing), or the apnea test is indeterminate.

Study Performed (Circle One):

1. Nuclear medicine cerebral blood flow scan
2. Four vessel angiogram
3. Electroencephalogram

Results of study:

Date: _____ Time _____

Interpreted by: _____ M.D.

For the examiner performing the second neurologic examination: Have either of the following sets of criteria (I or II) been established?

Mark EITHER I OR II as "YES":

- _____ I. An appropriate mechanism for permanent loss of whole brain function exists and has been documented in section A, if applicable, the appropriate observation period has elapsed (item 1 in section B is marked "Yes" or "N/A"), confounding factors have been excluded (all items in section C are marked "Yes"), two clinical examinations are consistent with brain death (all items in sections D and E are marked "Yes" and the timing of the exams is documented in section F), and an apnea test is consistent with brain death and is documented in section G.



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- ____ II. In the event that E or G cannot be fully determined because the injury or condition precludes evaluation e.g., facial injury precluding caloric testing; apnea test is indeterminate, then the following apply:
1. ALL items that are assessable in E are YES, and
 2. A confirmatory test is consistent with brain death and is documented in section H
 3. The apnea test validates the clinical diagnosis of brain death (except for those individuals whose apnea test is indeterminate)

CERTIFICATION of Brain Death by Clinical Examiner

On the basis of the findings recorded above, indicating irreversible loss of function of the entire brain as described in hospital policy, I certify that patient _____ is dead.

DATE _____ TIME _____ PHYSICIAN SIGNATURE* _____ M.D. NAME PRINTED _____ M.D.

*This record must be signed by the attending physician with privileges to determine brain death, the second-year Neurocritical Care fellow, or the PGY-7 (or higher) Neurosurgery resident who has conducted the second clinical examination of the patient and certifies him/her to be dead.

Note: If organ donation is contemplated, the physician who certifies brain death cannot participate in the procedure for removing or transplanting the organ.

Methodology for Performing Off-Ventilator Apnea Test

(Record results in section G, on Page 2)

1. After 15 minutes of pre-oxygenation on 100% oxygen and confirmation by ABG that the PaCO₂ is between 35-45 mmHg, an apnea test is performed while the patient is disconnected from the ventilator. Ten minutes is usually sufficient. O₂ should be passively delivered by placing tubing down the endotracheal tube and delivering oxygen at a rate no greater than 6 lpm.
2. After 10 minutes, the patient is reconnected to the ventilator while awaiting blood gas results. If over the ten minutes off the respirator there are no respiratory movements, and the final PaCO₂ is greater than or equal to 60 mmHg (option: 20 mmHg rise over baseline PaCO₂), the apnea test is **positive** (i.e., it validates the clinical diagnosis of brain death).
3. If the patient becomes hemodynamically unstable or cardiac arrhythmias develop, an ABG should be obtained, if possible, and the test should be discontinued with the patient placed back on the ventilator.
4. If prior loss of CO₂ responsiveness is suspected, as in patients with chronic CO₂ retention, a final value of pH less than 7.26 (from a patient with pre-test pH of greater than 7.40) can be used as an adequate test.
5. If the final PaCO₂ is less than 60 mmHg, or less than a 20 mmHg rise in PaCO₂ from baseline (or in patients with loss of CO₂ responsiveness the final pH is greater than 7.26), then the test is indeterminate. If the patient becomes hemodynamically unstable or cardiac arrhythmias develop, the test should be discontinued and considered indeterminate.

Methodology for Performing On-Ventilator Apnea Test

(Record results in section G, on Page 2)

See PPMC Policy, “Respiratory Response Testing in the Determination of Brain Death Utilizing Mechanical Ventilator”

1. Pre-Oxygenate on 100% FiO₂ for 15 minutes and confirm PaCO₂ of 35-45 mmHg via ABG.
2. Attending Physician may request ETCO₂ monitoring.
3. Physician, Nurse, and Respiratory Therapist must be at bedside for duration of test.
4. Ventilator:
 - a. Change mode of ventilation to assist control
 - b. Reduce set respiratory rate to 2/min
 - c. Reduce tidal volume to 1/2 current setting (dead space)
 - d. Reduce Peak Flow to appropriate level
 - e. Set apnea interval to 60 seconds
 - f. Set low expiratory minute volume alarm to zero L/min
 - g. Set low expiratory tidal volume alarm to 100 mL below set tidal volume
 - h. Set pressure sensitivity to -2 cm H₂O (*do not use flow sensitivity, as auto cycling can occur*)
 - i. Set FiO₂ to 100%.
 - j. Maintain previous PEEP level (PEEP may be increased if clinically indicated).
5. After 10 minutes, obtain ABG and return the patient to their previous ventilator settings.
6. If after 10 minutes there are no respiratory movements, and the final PaCO₂ is greater than or equal to 60 mmHg or 20 mmHg over baseline PaCO₂, the apnea test is positive.
7. If prior loss of CO₂ responsiveness is suspected, as with Chronic CO₂ retention, a final value of pH less than 7.26 (from a patient with pre-test pH of greater than 7.40) can be used as an adequate test.
8. If patient becomes hemodynamically unstable or cardiac arrhythmias develop, an ABG should be obtained, if possible, and the test should be discontinued with the patient returned to their previous ventilator settings.
9. If the final PaCO₂ is less than 60 mmHg or less than 20 mmHg rise in PaCO₂ from baseline (or in patients with loss of CO₂ responsiveness the final pH is greater than 7.26), then the test is indeterminate.

Methodology for Performing ECMO Apnea Test

(Record results in section G, on Page 2)

1. Pre-oxygenate patient for 15 minutes by placing the ventilator FiO₂ at 100% and ECMO FiO₂ at 100% and maintaining continuous positive airway pressure (CPAP) at the pre-apnea testing pressure.
2. Obtain baseline arterial blood gas (ABG) and ensure that baseline PaCO₂ is 35-45 mmHg.
3. Continue FiO₂ of 100%, CPAP at pre-apnea testing level, and reduce ECMO gas sweep to 0.5 L/minute.
4. Observe patient for 10 – 15 minutes and at the end of the observation period obtain a repeat ABG.
5. The apnea test should be aborted if the patient experiences hemodynamic instability (i.e., mean arterial blood pressure falls to less than 65 mmHg) or hypoxia. For patients on V-A (venoarterial) ECMO, cardiac arrhythmias do not necessitate aborting the apnea test so long mean arterial blood pressure remains greater than or equal to 65 mmHg and arterial oxygen saturation remains greater than or equal to 90%. For patients on V-V (venovenous) ECMO, the apnea test should be aborted if new unstable arrhythmias develop during the test.
6. At the end of the apnea test, place the ventilator and ECMO circuit back to clinically appropriate settings.
7. If, after at least 10 minutes of observation, the final PaCO₂ is greater than 60 mmHg (option: 20 mmHg rise over baseline PaCO₂) AND there have been no spontaneous respirations AND no evidence of patient-initiated breaths on the ventilator, then the apnea test is consistent with brain death.
8. If prior loss of CO₂ responsiveness is suspected, as in patients with chronic CO₂ retention, then a final value of pH less than 7.26 (in a patient with a pre-test pH of greater than 7.4) can be used as an adequate test.
9. If the final PaCO₂ is less than 60 mmHg or if there is less than 20 mmHg rise in PaCO₂ from baseline (or if the final pH greater than 7.26 in patients with chronic CO₂ retention), then the test is indeterminate. If the test must be aborted due to physiological instability, then the test should be considered indeterminate.

DO NOT USE UNAPPROVED ABBREVIATIONS