**Determination of Death by Neurological Criteria**

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**PRE-EVALUATION**

Patient is suspected to meet criteria for neurological death\(^1,2\)
- Patient has irreversible coma with known proximate cause
- Absence of brainstem reflexes and respiratory drive
- Neuroimaging correlates with cause of coma

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**EVALUATION (to be performed by Attending Intensivist, Neurologist, or Neurosurgeon)**

- **Stop all medications that may interfere with the diagnosis of brain death, per discretion of Intensivist/Neurologist**
- **Conduct a multidisciplinary family meeting to discuss suspected brain death**
- **Inform nursing and initiate consults for assistance and counseling as appropriate**
  - Social Work
  - Chaplain
- **If any member of the clinical team feels that the diagnosis of brain death is not appropriate or is questioned/opposed by the patient’s representative/family, contact Administration, Ethics, Risk Management, and Legal services as needed\(^3\)**
- **Physician and clinical team must be aware of culture and trust issues raised by the family in any discussions**

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**Potential brain death, notify:**
- LifeGift\(^4\)
- ICU Nurse Manager
- Hospital Administrator/Nursing Off-Shift Administrator (NOSA)

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**Note:** Apnea test should not be performed if:
- Patient has a comorbid condition that prevents demonstration of spontaneous respiratory effort or
- Patient would be placed at undue risk to develop cardiac arrest

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\(^1\) For Death by Neurological Criteria Checklist, see Appendix A for adults and Appendix B for pediatrics. See Appendix C for Prerequisites for Physiologic Criteria Necessary Prior to Determination of Neurologic Death.

\(^2\) See Appendix D for Conditions That May Interfere with the Clinical Diagnosis of Brain Death

\(^3\) The family or any treating physician may request an Ethics consult under the Clinical Ethics Consultation Policy (#CLN0461)

\(^4\) LifeGift should be notified at time of death, or when death is known to be imminent to make an independent assessment of suitability

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See Page 2 for further testing.
Conduct one of the following ancillary tests (if clinical exam is inconclusive or unable to perform apnea test):

- Nuclear medicine brain scan with vascular flow
- Transcranial doppler ultrasonography (TCD) (Adult Only)
- Conventional 4-vessel cerebral angiography

Note: Ancillary studies are not required to establish brain death and are not a substitute for the neurologic examination. Choice of a single ancillary test is based on physician’s discretion and availability.

Is an ancillary exam necessary or preferred?  
Yes
No

- For adult patients proceed to Findings on Page 3
- For pediatric patients, a second clinical examination performed by a second physician following time duration between clinical exams as listed in Appendix F:
  - Assess for absence of all of the following:
    - Pupil reaction to light in both eyes
    - Corneal reflexes
    - Ocular movement with head turning (oculocephalic reflex) when no apparent cervical spine injury exists and ocular movements after caloric testing with ice water (oculovestibular reflex)
    - Sucking and rooting reflexes for infants younger than 6 months
    - Oropharyngeal reflex (gag and cough reflex)
    - Facial movement to noxious stimuli at supranuclear nerve, temporomandibular joint
    - Motor response to noxious stimuli in all four limbs
  - Perform apnea test unless contraindicated (see Appendix E)

  Note: Apnea test should not be performed if:
  - Patient has a comorbid condition that prevents demonstration of spontaneous respiratory effort or
  - Patient would be placed at undue risk to develop cardiac arrest

1 See Appendix D for Conditions That May Interfere with the Clinical Diagnosis of Brain Death
Determination of Death by Neurological Criteria

**FINDINGS**

1. If the practitioner is unwilling to pronounce the patient’s death, the Medical Director and/or the appropriate hospital Executive Officer shall be notified. Refer to the Accommodating Closely Held Personal and/or Religious Beliefs Policy (#ADM0260).
2. See the Care of the Deceased Policy (#CLN1084)
3. See the Pronouncement of Death by an Advanced Practice Provider Policy (#CLN0509)
4. LifeGift should be notified at time of death, or when death is known to be imminent to make an independent assessment of suitability
5. The time between pronouncement of death and discontinuation of mechanical support should not exceed 6 hours. Under rare circumstances, the time period may be extended by 24-48 hours on a case by case basis, following consultation with Legal services.
6. The family or any treating physician may request an Ethics consult under the Clinical Ethics Consultation Policy (#CLN0461)

**ACTIONS**

- Notify family of patient’s death and planned removal of mechanical support
- Inform nursing and initiate consults for assistance and counseling as appropriate
  - Social Work
  - Chaplain
- If removal of mechanical support is questioned/opposed by the patient’s representative/family at this stage, contact Administration, Ethics, Risk Management, and Legal services, as needed
- Plan for discontinuation of mechanical support measures with nursing, respiratory therapy, and family
- Nursing care for hygiene and family support
- Proceed with discontinuation of mechanical support

- If removal of mechanical support is questioned/opposed by the patient’s representative/family at this stage, contact Administration, Ethics, Risk Management, and Legal services, as needed
- Nursing care for hygiene and family support
- Proceed with discontinuation of mechanical support

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APPENDIX A: Death by Neurological Criteria Checklist - Adult

☐ Pre-Evaluation
☐ Family Meeting
   Attendees/discussed with:

☐ Notify LifeGift of potential Brain Death
☐ Clinical Examination
☐ Apnea Testing
   or
☐ Apnea test aborted
   Reason:

☐ Ancillary testing (only 1 needs to be performed; to be ordered only if clinical examination cannot be fully performed due to patient factors, or if apnea testing inconclusive or aborted)
☐ Continued Clinical Management
☐ Pronounce Death in accordance with policy
   ☐ Document time in medical record
☐ Notify LifeGift of Death
☐ Planned removal of Mechanical Support
☐ Organ Donation Procedures through LifeGift
☐ Documentation of all of the above in the Medical Record

Name of physician and signature:

Date & time:

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APPENDIX B: Death by Neurological Criteria Checklist - Pediatric

- Pre-Evaluation
- Family Meeting #1
  Attendees/discussed with:
  ___________________________________________________________
  ___________________________________________________________
  ___________________________________________________________
  ___________________________________________________________

- Notify LifeGift of potential Brain Death

- Clinical Examination #1

- Apnea Testing (Pediatric Considerations)
  or
  - Apnea test aborted
    Reason:
    ___________________________________________________________
    ___________________________________________________________
    ___________________________________________________________

- Ancillary testing (only 1 needs to be performed; to be ordered only if clinical examination cannot be fully performed due to patient factors, or if apnea testing inconclusive or aborted)

- Documentation of all of the above in the Medical Record

Name of physician and signature: (Exam 1)

Date & time

- Clinical Examination #2

- Apnea Testing (Pediatric Considerations)
  or
  - Apnea test aborted
    Reason:
    ___________________________________________________________
    ___________________________________________________________

- Continued Clinical Management

- Pronounce Death in accordance with policy
  - Document time in medical record

- Notify LifeGift of Death

- Planned removal of Mechanical Support

- Organ Donation Procedures through LifeGift

- Documentation of all of the above in the Medical Record

Name of physician and signature: (Exam 2)

Date & time

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## APPENDIX C: Prerequisites for Physiologic Criteria Necessary Prior to Determination of Neurologic Death

All of the following physical criteria must be met:

- Central nervous system drug effect absent (if indicated toxicology screen; if barbiturates given, serum level < 10 µg/mL)
- No evidence of residual paralytics (electrical stimulation if paralytics used)
- Absence of severe acid-base, electrolyte, endocrine abnormality
- Normothermia or mild hypothermia (core temperature > 36°C)
- No spontaneous respirations
- Systolic blood pressure (SBP):
  - Adults and children ≥ 10 years old: SBP ≥ 100 mmHg
  - Children 1-9 years old: SBP > [70 + (2 x age in years)] mmHg
  - Infant < 1 year old: SBP > 70 mmHg
  - Newborns < 28 days old: SBP > 60 mmHg

Per American Academy of Neurology (AAN) Guidelines

## APPENDIX D: Conditions That May Interfere with the Clinical Diagnosis of Brain Death

- Severe facial trauma
- Pre-existing pupil abnormalities
- Toxic levels of aminoglycosides, tricyclic antidepressants, anticholinergics, antiepileptic drugs or chemotherapeutic agents
- Anesthetic levels of opiates and sedatives
- Neuromuscular blocking medications
- Sleep apnea or severe pulmonary disease resulting in chronic retention of carbon dioxide
- Therapeutic hypothermia treatment
- Mydriatic medications, psychoactive substances, central nervous system depressants
APPENDIX E: Conducting Apnea Test

Step 1:
A. In adults, adjust vasopressors to a systolic blood pressure (SBP) ≥ 100 mmHg and mean arterial pressure (MAP) ≥ 75 mmHg.

B. In children, if hemodynamically unstable prior to or during apnea test, adjust vasopressor support to maintain SBP and MAP ≥ fifth percentile for age.

Then:
C. Give patient 100% oxygen for at least 10 minutes prior to starting the test. Manage ventilator rate to achieve partial pressure of carbon dioxide (PaCO₂) 35-45 mmHg. If not achievable, abort apnea test.

Step 2:
Obtain baseline arterial blood gases (ABGs) then disconnect the patient from the ventilator.

Step 3:
Once disconnected, insert oxygen source into endotracheal tube (ETT) and give patient oxygen at flow rate of 6 L/minute (loose fitting catheter through ETT).

Step 4: Observation/Evaluation
A. If patient exhibits any of the following: hypoxia, arrhythmia, or hypotension (SBP persistently < 90 mmHg in adults and children 10 years of age or older despite adjustment of vasopressors; for younger children use Appendix B for blood pressure parameters). Abort test immediately and draw ABG.

B. If no symptoms as listed in ‘A’, continue observation for required time period.

C. Observe adult and pediatric patients carefully for respiratory effort for approximately eight (8) minutes. Draw serial ABG’s (approximately every 2 minutes) beginning at approximately 8 minutes of apnea until the ABG results are consistent with the criteria below:

### Observations

- No respirations or effort occurs and
- Arterial pH level is < 7.30 and
- PaCO₂ levels:
  - In patients who are known not to have chronic carbon dioxide (CO₂) retention, the PaCO₂ level is ≥ 60 mmHg and ≥ 20 mmHg above the patient’s pre-apnea test baseline level
  - In patients who are known to have chronic CO₂ retention, and the baseline PaCO₂ is known, the PaCO₂ level is ≥ 60 mmHg and ≥ 20 mmHg above the patient’s known chronic elevated premorbid baseline level
  - In patients who are suspected to have chronic CO₂ retention, but the baseline PaCO₂ is unknown, the PaCO₂ level is ≥ 60 mmHg and ≥ 20 mmHg above the patient’s pre-apnea test baseline level, and an ancillary test is required

### Evaluation

- Continue with clinically appropriate management

- Apnea test is satisfactorily completed and positive (supports the clinical diagnosis of brain death)
- If not, result indeterminate; consider an additional ancillary test
- If result is inconclusive and patient is hemodynamically stable, consider continuing the test for a longer period (11-15 minutes)

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1 Note: Responsible attending physician (Intensivist, and/or Neurologist/Neurosurgeon) present at the bedside immediately prior to disconnecting the patient from the ventilator and during the apnea test

2 If the apnea test cannot be completed because of hemodynamic instability, desaturation to < 85%, inability to reach a PaCO₂ of > 60 mmHg, or is contraindicated, then an ancillary study should be performed

3 Point of care testing is recommended

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Department of Clinical Effectiveness V7
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### APPENDIX F: Minimum Time Duration Between Clinical Exams

<table>
<thead>
<tr>
<th>Age</th>
<th>Hours Between Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term newborns (37 weeks gestational age) – 30 days of life</td>
<td>24</td>
</tr>
<tr>
<td>Infants 31 days old – children 18 years old</td>
<td>12</td>
</tr>
</tbody>
</table>

Per American Academy of Pediatrics (AAP) Guidelines
Determination of Death by Neurological Criteria

SUGGESTED READINGS


MD Anderson Institutional Policy # ADM0260 – Accommodating Closely Held Personal and/or Religious Beliefs Policy

MD Anderson Institutional Policy # CLN1084 – Care of the Deceased Policy

MD Anderson Institutional Policy # CLN0461 – Clinical Ethics Consultation Policy

MD Anderson Institutional Policy # CLN0557 – Determination of Medical Appropriateness Policy

MD Anderson Institutional Policy # CLN0509 – Pronouncement of Death by an Advanced Practice Provider Policy


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DEVELOPMENT CREDITS

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