Determination of Death by Neurological Criteria

PRE-EVALUATION

Patient is suspected to meet criteria for neurological death 1,2,3
- Patient is in a comatose state or unresponsive to all stimuli (no spontaneous movement other than spinal reflexes)
- Cessation of brainstem function
- Irreversible cessation of spontaneous brain function
- Cerebral imaging that correlates with suspicion of brain death

Stop all medications that may interfere with diagnosis of brain death, per discretion of Intensivist/Neurologist

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

- Conduct multidisciplinary family meeting to discuss suspected brain death
- Inform nursing and initiate consults for assistance and counseling as appropriate
  - Social work
  - Chaplain
- If questioned/opposed by patient representative/family, contact Administration, Ethics, Risk Management, and Legal services, as needed4
- Physician and clinical team must be aware of culture and trust issues raised by the family in any discussions

- Assess for absence 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)
  - Bulbar function (jaw reflex)
  - Oropharyngeal reflex (gag and cough reflex)
  - Pain reflex
- Perform apnea test, unless contraindicated (see Appendix D)
  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

Notify LifeGift 5, dayshift ICU Nurse Manager/Nursing Off-Shift Administrator (NOSA) and Hospital Administrator of potential brain death

1 See Appendix A for Death by Neurological Criteria Checklist
See Appendix B for Neurological Criteria for Brain Death
2 The following conditions 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 CO2
- Therapeutic hypothermia treatment
- Mydriatic medications

3 If the practitioner is unwilling to pronounce the patient’s death, the Medical Director and/or the appropriate hospital Executive Officer shall be notified (Policy UTMDACC #ADM0260)
4 The family or any treating physician may request an Ethics consult under Clinical Ethics Consultation Policy (Policy UTMDACC #CLN0461)
5 LifeGift should be notified at time of death, or when death is known to be imminent to make an independent assessment of suitability (Policy UTMDACC #CLN0557)

Stop all medications that may interfere with diagnosis of brain death, per discretion of Intensivist/Neurologist

See Page 2 for further testing

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient’s care. This algorithm should not be used to treat pregnant women.
Determinant of Death by Neurological Criteria

**TESTING FOLLOWING EVALUATION**

Conduct ancillary tests (if clinical exam is inconclusive or unable to perform apnea test):
- Nuclear medicine brain scan with vascular flow
- Brain Death Protocol electroencephalogram (EEG)
- Transcranial doppler ultrasonography (TCD)
- CT angiogram head with and without contrast

**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 discretion and availability.

Is an ancillary exam necessary or preferred?*

Yes

Second clinical examination performed by a second physician following time duration between clinical exams as listed in Appendix C:
- **Absence** 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)
  - Bulbar function (jaw reflex)
  - Oropharyngeal reflex (gag and cough reflex)
  - Pain reflex

- Perform apnea test unless contraindicated* (see Appendix D)

**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

---

* The following conditions 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 pulmonal disease resulting in chronic retention of CO$_2$
- Therapeutic hypothermia treatment
- Mydriatic medications

---

 approved by the Executive Committee of the Medical Staff on 10/30/2018

**Disclaimer:** This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.
**Determination of Death by Neurological Criteria**

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient’s care. This algorithm should not be used to treat pregnant women.

---

**FINDINGS**

- Criteria for neurological death met?
  - Yes
  - No

**ACTIONS**

- Pronounce death in accordance with policy, document time in medical record and discontinue nursing assessments
  - Yes
  - No

- Notify LifeGift of death

- Conduct multidisciplinary family meeting to discuss patient’s death and planned removal of mechanical support
- Inform nursing and initiate consults for assistance and counseling as appropriate
  - Social work
  - Chaplain
- If planned removal of mechanical support is questioned/opposed by patient representative/family, contact Administration, Ethics, Risk Management, and Legal services, as needed
- Physician and clinical team must be aware of culture and trust issues raised by the family in any discussions

- Planned discontinuation of life-sustaining measures
- Nursing care for hygiene and family support

- Proceed with discontinuation of life support

---

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 (Policy UTMDACC #ADM0260)
2. See Care of the Deceased (Policy UTMDACC #CLN1084)
3. See Pronouncement of Death by a Mid-Level Provider (Policy UTMDACC #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 (Policy UTMDACC #CLN0557)
5. The family or any treating physician may request an Ethics consult under Clinical Ethics Consultation Policy (Policy UTMDACC #CLN0461)
6. This time between pronouncement of death and discontinuation of mechanical support should not exceed 6 hours. Under rare or unusual circumstances, this time period may be extended 24 to 48 hours on a case by case basis following consultation by Legal services.
APPENDIX A: Death by Neurological Criteria Checklist

☐ Pre-Evaluation

☐ Family Meeting #1
Attendees/discussed with:
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

☐ Notify LifeGift of potential Brain Death

☐ Clinical Examination #1

☐ Apnea Testing (Pediatric Considerations)
☐ Apnea test aborted
Reason:
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

☐ Continued Clinical Management
☐ Pronounce Death in accordance with policy
☐ Document time in medical record

☐ Notify LifeGift of Death

☐ Family Meeting #2
Attendees/discussed with:
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

☐ Ancillary testing OPTIONAL (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)

☐ Planned removal of Life Support
☐ Organ Donation Procedures through LifeGift

☐ Documentation of all of the above in the Medical Record

☐ Documentation of all of the above in the Medical Record

Name of physician and signature (Exam 1)

Date & time

Name of physician and signature (Exam 2)

Date & time
Determination of Death by Neurological Criteria

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient’s care. This algorithm should not be used to treat pregnant women.

APPENDIX B: Physical Criteria Necessary to Accompany Determination of Neurologic Death

All of the following physical criteria must be met:

- Patient older than seven (7) days of age
- Rule out drug intoxication and reversible metabolic conditions that may obscure brain function; patient needs to be off all sedative medications or medications that reduce brain metabolic rate (e.g., propofol, fentanyl, midazolam, barbiturates, etc.) which might obscure the exam
- Patient’s body temperature greater than 32.2°C (90°F)
- Systolic blood pressure (SBP):
  - Adults and children greater than or equal to 10 years old: SBP greater than or equal to 90 mmHg
  - Children 1-9 years old: SBP greater than [70 + (2 x age in years)] mmHg
  - Infant less than 1 year old: SBP greater than 70 mmHg
  - Newborns less than 28 days old: SBP greater than 60 mmHg

APPENDIX C: Minimum Time Duration Between Clinical Exams

<table>
<thead>
<tr>
<th>Age</th>
<th>Hours Between Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term birth (37 weeks gestation) – 1 month</td>
<td>24</td>
</tr>
<tr>
<td>1 month – 18 years</td>
<td>12</td>
</tr>
<tr>
<td>Greater than 18 years</td>
<td>6</td>
</tr>
</tbody>
</table>

Per American Academy of Pediatrics (AAP) and American Academy of Neurology (AAN) Guidelines
APPENDIX D: Conducting Apnea Test

Step 1:
A. In adults, adjust vasopressors to a systolic blood pressure (SBP) greater than or equal to 100 mmHg. In children, if hemodynamically unstable prior to or during apnea test, adjust vasopressor support to acceptable mean arterial pressure for age. Then:
B. Give patient 100% oxygen for at least 10 minutes prior to starting the test. Manage ventilator rate to achieve PaCO₂ 35 - 45 mmHg. If not achievable, abort apnea test.

Step 2:
Obtain baseline arterial blood gases (ABGs) then disconnect patient from ventilator.¹³

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

Step 4: Observation/Evaluation
A. If patient exhibits any of the following: hypoxia, arrhythmia or hypotension (SBP persistently less than 90 mmHg in adults and children greater than or equal to 10 years despite adjustment of vasopressors; for younger children use Appendix B for blood pressure parameters). Abort test immediately and draw ABGs³.
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 ten (10) minutes. Draw ABG’s at end of observation time period and review results³:

<table>
<thead>
<tr>
<th>Observations</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to complete due to physical condition</td>
<td>Continue with clinically appropriate management</td>
</tr>
<tr>
<td>Respiratory movements absent and PaCO₂ greater than or equal to 60 mmHg or increase of 20 mmHg greater than baseline normal² PaCO₂</td>
<td>Apnea test satisfactorily completed and is positive (supports the clinical diagnosis of brain death)</td>
</tr>
<tr>
<td></td>
<td>If not, result indeterminate; consider an additional ancillary test</td>
</tr>
<tr>
<td></td>
<td>If result inconclusive and patient is hemodynamically stable: consider continuing test for longer period (10-15 minutes)²</td>
</tr>
</tbody>
</table>

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 Children: if the rise in PCO₂ fails to reach 60 mmHg, perform the test again for a duration of 15 minutes

³ Point of care testing is recommended
Determination of Death by Neurological Criteria

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.

SUGGESTED READINGS


UTMDACC Institutional Policy #ADM0260 – Accommodating Closely-Held Personal and/or Religious Beliefs Policy

UTMDACC Institutional Policy #CLN1084 – Care of the Deceased Policy

UTMDACC Institutional Policy #CLN0461 – Clinical Ethics Consultation Policy

UTMDACC Institutional Policy #CLN0557 – Determination of Medical Appropriateness Policy

UTMDACC Institutional Policy #CLN0509 – Pronouncement of Death by a Mid-Level Provider Policy


Determination of Death by Neurological Criteria

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson’s specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.

DEVELOPMENT CREDITS

This practice consensus algorithm is based on majority expert opinion of The Neurologic Death Task Force of the ICU Best Practice Committee Members at the University of Texas MD Anderson Cancer Center for the patient population. These experts included:

John Crommett, MD (Critical Care and Respiratory Care)\textsuperscript{T}
Angela Hayes-Rodgers, MBA/HCM (Off-Shift Administration)
Shonice Holdman, MBA\textsuperscript{*}
Rodrigo Mejia, MD (Pediatrics – Patient Care)\textsuperscript{T}
Jessica Moore, MA, DHCE (Critical Care and Respiratory Care)\textsuperscript{T}
Joseph Nates, MD (Critical Care and Respiratory Care)\textsuperscript{T}
Komal Shah, MD (Diagnostic Imaging)
John Slopis, MD, MPH (Neuro-Oncology)
Mary Lou Warren, DNP, RN, CNS-CC (Critical Care and Respiratory Care)
Jeffrey Weinberg, MD (Neurosurgery)
Sonal Yang, PharmD\textsuperscript{*}

\textsuperscript{T} Core Development Team
\textsuperscript{*} Clinical Effectiveness Development Team