

Neurologic

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Indications to Consult Neuro Critical Care

Overview: The UNMC Neurocritical Care Service will provide consult service to assist in the care of patients in adult ICUs. The Neurocritical Care Consult service will not replace either the Neurology Consult Service or the Stroke Service. The goal is to assist in management of critical neurologic issues in patients being managed with other critical care needs.

The inpatient Neurocritical care service is available: 24/7. The team can see youth ages 6 and above, and all adults.

For youth ages <5, pediatric Neurology is available to interpret EEGs.

Patients for whom consultation would be appropriate:

1. Need EEG (POC or continuous) with concern for seizure
2. Management of seizures/status epilepticus
3. Evaluation of encephalopathies
4. Meningitis/encephalitis
5. Prognosis of anoxic injury
6. Traumatic brain injury
7. Patient requiring Tier 2 treatment with neuromuscular paralysis for intracranial hypertension or MAP challenge
8. Patient requiring Level 3 treatment with barbiturate coma for intracranial hypertension
9. Other critical neurologic issues

A neurocritical care attending will round daily on all consults and in conjunction with SCC team (time TBD)

Stroke Codes should continue to be called for all acute events where stroke is suspected in order to expedite appropriate evaluation and acute intervention by the Stroke Service.

To arrange for neurocritical care consultation in EPIC order the academic Neurology consult and in the perfect serve communication add "neurocritical care consult".

A Perfect Serve link for communication with the Neurocritical Care Service exists.

For questions, concerns, problems call Dr Gress, (434) 981-9366

Nebraska Medicine Brain Death Criteria

Nebraska Medicine Policy Number: MS 29

Purpose

To give an accurate and complete description required to establish a diagnosis of breath death/Death by Neurological Criteria (BD/DNC), and to describe the roles and responsibilities of various clinicians and staff members in the process.

Scope

This policy applies to all patients at least 37 weeks corrected gestational age or older at Nebraska Medicine for whom a diagnosis of BD/DNC is considered.

Background

Nebraska Medicine follows the definition of BD/DNC as established by the State of Nebraska in statute 71-7202 and utilizes the accepted medical standards for determining BD/DNC.

A diagnosis of breath death is a clinical diagnosis that can only be established by a staff physician with privileges in neurology or critical/intensive care medicine. The staff physician will document the results of the brain death evaluation in the medical record. The time of death is determined at the time the evaluation is complete. Physicians in training, who are at an advanced level of training and deemed appropriate by the staff physician and working under the staff physician's *direct* supervision, can perform parts of the examination. The staff physician is fully responsible for the diagnosis, declaration, and documentation of brain death.

Brain Death Evaluation

A complete brain death evaluation consists of three components. All three components must be completed to establish a diagnosis of brain death:

1. Establish permanent and proximate cause of coma
2. Establish absence of cortical function and brain stem reflexes by neurologic examination
3. Establish absence of spontaneous respirations by performing an apnea test

Completion of the three components of the brain death evaluation is sufficient to establish a diagnosis of brain death.

Ancillary Testing

Ancillary testing is not required if all three of the above components are completed. Ancillary tests may be used to support the diagnosis of brain death when uncertainty exists about the reliability of parts of the neurologic exam, when parts of the exam cannot be performed, or to shorten the interval between exams. The current acceptable ancillary tests are: Cerebral angiography, cerebral scintigraphy, and transcranial doppler (if age appropriate).

The interpretation of these tests must be interpreted by a staff physician with the required level of expertise.

Special circumstances:

1. Physicians with recognized or potential conflicts of interest in relation to the outcome of the patient's care must remove themselves from the BD/DNC evaluation. For instance, a transplant service physician whose patient expires and has the potential for organ donation should excuse himself/herself from declaring the patient brain dead.

References

1. Nebraska State Statute 71-7202. Determination of death. Source: Laws 1992, LB 906, 2.
2. Pediatric and Adult Brain Death/Death by Neurologic Criteria Consensus Guideline. *Neurology*. Dec 12, 2023 issue: 101(24):1112-1132. Greer DM, Kirschen MP, Lewis A, Gronseth GS, Rae-Grant A, Ashwal S, Babu MA, Bauer DF, Billingham L, Corey A, Partap S, Rubin MA, Shutter L, Takahashi C, Tasker RC, Varelas PN, Wijdicks E, Bennett A, Wessels SR, Halperin JJ.
3. The 2023 AAN/AAP/CNS/SCCM Pediatric and Adult Brain Death/Death by Neurologic Criteria Consensus Practice Guideline. A Comparison with the 2010 and 2011 Guidelines. Ariane Lewis, MD <https://orcid.org/0000-0002-075807320>, Matthew P. Kirschen MD, PhD <https://orcid.org/0000-0003-358502687>, and David Greer, MD <https://orcid.org/0000-0002-2026-8333> AUTHORS INFO & AFFILIATIONS. December 2023 issue.

Related Policies and Procedures

Acute Bereavement Care -- TX02

Staff Accountability:

- Critical Care Medicine (09/2024)
- Medical Ethics Committee (09/2024)
- Pediatric Quality Committee (11/2024)
- Medical Staff Bylaws Committee NMC (11/2024)
- Medical Staff Medical Executive Committee NMC (11/2024)
- Board of Directors (11/2024)

Brain Death/Death by Neurologic Criteria (BD/DNC) Evaluation

Nebraska Medicine follows the definition of BD/DNC as established by the State of Nebraska in statute 71-7202 and utilizes the accepted medical standards for determining BD/DNC

Available at: nebraskalegislature.gov/laws/statutes.php?statute=71-7202&print=true

Additional metabolic derangements, drug-specific information and BD/DNC Guidelines are available as a reference however, the exact abnormal values at which could affect the clinical evaluation are uncertain and determination will be at the discretion of the provider.

Available at: https://cdn-links.lww.com/permalink/wnl/d/wnl_2023_11_20_wessels_1_sdc4.pdf

Patient last name:	Patient first name:	DOB:	MRN:
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SECTION I. PREREQUISITES FOR CLINICAL EXAMINATION

1. Ascertainment that the patient has sustained a catastrophic, permanent brain injury caused by an identified mechanism that is known to lead to BD/DNC	<input type="checkbox"/> Yes <input type="checkbox"/> No Etiology: _____
2. Neuroimaging has been obtained it is consistent with mechanism and severity of brain injury (i.e., in patients with primary posterior fossa injury, neuroimaging should demonstrate catastrophic supratentorial injury)	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Observation for permanency: a) ≥48 hours after acute brain injury (particularly ischemic brain injury) for patients ≤ 24 months old OR b) ≥24 hours after hypoxic ischemic brain injury for patients ≥24 months old OR c) A sufficient amount of time after brain injury to ensure there is no potential for recovery of brain function as determined by the evaluator based on the pathophysiology of the brain injury	<input type="checkbox"/> Yes <input type="checkbox"/> No Observation period (hours): _____
4. Core temperature should be 96.8°F / 36°C or greater for 24 hours.	<input type="checkbox"/> Yes <input type="checkbox"/> No Temperature (°C): _____
5. Recommend systolic blood pressure (SBP) ≥100 mm Hg for patients 19 years of age or older with adjustment in consideration to known underlying illness/chronic disease that varies from their age based normal OR SBP and MAP ≥5 th percentile for patients 37 weeks corrected gestational age up to 19 years of age. OR Patients 19 years of age or older on ECMO: VV reach systolic MAP Pressure of ≥100 mmHg and VA target of ≥75 mm Hg mean arterial pressure only OR Patients less than 19 years of age on venoarterial extracorporeal membranous oxygenation (VA-ECMO) MAP ≥5 th percentile for age-(Please reference pediatric table 1)	<input type="checkbox"/> Yes <input type="checkbox"/> No SBP (mm Hg): _____ MAP (mm Hg): _____
6. Consider exclusion of pharmacologic paralysis (if administered or suspected) through use of train-of-four stimulator or demonstration of deep tendon reflexes	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not indicated
7. Pharmacy Consultation regarding drug levels (if testing is available) for medications that may suppress central nervous system function are therapeutic/subtherapeutic <ul style="list-style-type: none"> If clinically indicated, ensure blood and urine drug screen are negative pentobarbital level is <5 mcg/mL (if the patient received phenobarbital) and at least five half-lives for all other such drugs have passed (longer if there is renal/hepatic dysfunction or if the patient is obese or was hypothermic). 	<input type="checkbox"/> Yes <input type="checkbox"/> No
8. Alcohol blood level ≤80 mg/dL (if clinically indicated)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not indicated
10. Exclusion of severe metabolic, acid-base, and endocrine derangements	<input type="checkbox"/> Yes <input type="checkbox"/> No
Prerequisite Summary (check one):	
<input type="checkbox"/> All prerequisites were met	
<input type="checkbox"/> Unable to adequately correct metabolic derangements, but all other prerequisites were met, so will complete the clinical exam and if they are consistent with BD/DNC, will perform ancillary testing	

SECTION II. CLINICAL EXAM (MUST be completed to fullest extent possible)		Yes	No	Not Tested
*Patients less than 19 years of age require two exams at least 12 hours apart by two qualified, independent staff physicians (unless ancillary testing is performed to shorten the interval)				
First exam with a check box for Attending				
Second exam with a check box for 2 nd Pediatric Attending				
12. Coma-with unresponsiveness-to-visual-auditory-and-tactile-stimulation		<input type="checkbox"/>	<input type="checkbox"/>	
13. Absent motor responses, other than spinally mediated reflexes, of the head/face, neck, and extremities		<input type="checkbox"/>	<input type="checkbox"/>	
14. Absent pupillary responses to bright light bilaterally		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Absent oculocephalic reflex unless there is concern for cervical spine or skull base integrity		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Absent oculovestibular reflexes bilaterally		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Absent corneal reflexes bilaterally		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Absent gag reflex		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Absent cough reflex		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Absence of sucking and rooting reflexes (patients <6-months only)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clinical examination results (check one):				
(1st Attending)				
<input type="checkbox"/> All elements-of-the clinical-exam were completed, and findings consistent with BD/DNC				
(*2nd Exam by Pediatric Attending)				
<input type="checkbox"/> All elements of the clinical exam were completed, and findings consistent with BD/DNC				
(1st Attending)				
<input type="checkbox"/> A portion of the clinical exam other than the oculocephalic reflex could not be assessed safely or it was unclear whether observed limb movements were spinally mediated (note that even if a person does not have all limbs, painful stimulation can still be provided to the torso as close to the termination of the limb as possible, so this does not necessitate ancillary testing); however, the remainder of the test was performed to the fullest extent possible and responses were consistent with BD/DNC. (Ancillary testing is required.) Reason(s) for incomplete testing (check all that apply): <input type="checkbox"/> Anophthalmia; <input type="checkbox"/> Corneal trauma or transplantation; <input type="checkbox"/> Fracture of the base of the skull or petrous temporal bone; <input type="checkbox"/> High cervical cord injury; <input type="checkbox"/> Ophthalmic surgery that influences pupillary reactivity; <input type="checkbox"/> Severe facial trauma; <input type="checkbox"/> Severe pre-existing neuromuscular disorder; <input type="checkbox"/> Severe orbital or scleral edema or chemosis; <input type="checkbox"/> Limb movements that may be spinally mediated; <input type="checkbox"/> Other (specify): _____				
(*2nd Exam by Pediatric Attending)				
<input type="checkbox"/> A portion of the clinical exam other than the oculocephalic reflex could not be assessed safely or it was unclear whether observed limb movements were spinally mediated (note that even if a person does not have all limbs, painful stimulation can still be provided to the torso as close to the termination of the limb as possible, so this does not necessitate ancillary testing); however, the remainder of the test was performed to the fullest extent possible and responses were consistent with BD/DNC. (Ancillary testing is required.) Reason(s) for incomplete testing (check all that apply): <input type="checkbox"/> Anophthalmia; <input type="checkbox"/> Corneal trauma or transplantation; <input type="checkbox"/> Fracture of the base of the skull or petrous temporal bone; <input type="checkbox"/> High cervical cord injury; <input type="checkbox"/> Ophthalmic surgery that influences pupillary reactivity; <input type="checkbox"/> Severe facial trauma; <input type="checkbox"/> Severe pre-existing neuromuscular disorder; <input type="checkbox"/> Severe orbital or scleral edema or chemosis; <input type="checkbox"/> Limb movements that may be spinally mediated; <input type="checkbox"/> Other (specify): _____				
_____ Attending name (printed)		_____ Signature		_____ Date
_____ Attending #2 for Pedi only (printed)		_____ Signature		_____ Date
				_____ Time
				_____ Time

SECTION III. APNEA TEST		Yes	No
APNEA TESTING PREREQUISITES – only to be performed by staff physicians with ventilator privileges			
22. pH is normal (7.35-7.45) unless patient has a known chronic baseline acidemia and PaCO ₂ is normal (35-45 mm Hg), OR PaCO ₂ is at baseline (if baseline is known), OR at estimated baseline if baseline is not known		<input type="checkbox"/>	<input type="checkbox"/>
Note: ABGs should be taken from both the distal arterial line and the ECMO post oxygenator for patients on VA-ECMO.		pH: _____ PaCO ₂ : _____	
23. PaO ₂ is >200 mm Hg after ≥10 minutes of preoxygenation with FiO ₂ 1.0 (100% oxygen)		<input type="checkbox"/>	<input type="checkbox"/>
		PaO ₂ : _____	

APNEA TESTING PERFORMED?	<input type="checkbox"/>	<input type="checkbox"/>
24. Apnea duration	Minutes: _____	
25. Post-apnea PaCO ₂ value (mm Hg)	PaCO ₂ : _____	
26. Post-apnea pH value	pH: _____	
Final apnea testing results (check one):		
<input type="checkbox"/> Apnea confirmed: no respirations AND targets reached (pH <7.30 AND final PaCO ₂ ≥60 mm Hg AND final PaCO ₂ ≥20 mm Hg above pre-apnea test baseline OR final PaCO ₂ ≥20 mm Hg above chronic baseline for patients known to have chronic hypercarbia). *Ancillary testing is required if patient is known/suspected to have chronic hypercarbia, without a known baseline PaCO ₂ .		
<input type="checkbox"/> Apnea testing is inconclusive due to: _____ <input type="checkbox"/> Hypotension despite titration of vasopressors, inotropes, and/or IV fluids _____ <input type="checkbox"/> Progressive hypoxia _____ <input type="checkbox"/> Cardiac arrhythmia with hemodynamic instability		
<input type="checkbox"/> Apnea testing is negative – one or more spontaneous respirations were seen; findings are not consistent with BD/DNC		
_____	_____	_____
Attending name (printed)	Signature	Date Time

SECTION IV. ANCILLARY TESTING	
27. Reason(s) for ancillary testing	<input type="checkbox"/> Inability to correct metabolic derangements <input type="checkbox"/> Inability to complete all clinical tests (e.g., fracture of the cervical spine, skull base, orbits, face) <input type="checkbox"/> Inability to complete apnea test due to risk of cardiopulmonary decompensation or inability to interpret PaCO ₂ level in a patient with chronic hypercarbia for whom chronic baseline is unknown <input type="checkbox"/> Uncertainty regarding interpretation of spinally vs. cerebrally mediated motor responses
28. Type of ancillary testing performed (the tests listed here are the ONLY acceptable ancillary tests)	<input type="checkbox"/> Conventional 4-vessel catheter angiography (digital subtraction angiography) <input type="checkbox"/> Cerebral scintigraphy <input type="checkbox"/> Transcranial doppler ultrasonography (19 years of age or older only)
Final ancillary testing results (check one):	
<input type="checkbox"/> Ancillary testing results are consistent with BD/DNC <input type="checkbox"/> Ancillary testing results are not consistent with BD/DNC	

SECTION V. SUMMARY OF FINDINGS	
<input type="checkbox"/>	BRAIN DEATH/DEATH BY NEUROLOGIC CRITERIA DETERMINED CLINICALLY <ul style="list-style-type: none"> Prerequisites for clinical testing have been fulfilled (Section I) and Results of clinical exams, including apnea testing, have been fully completed and are consistent with BD/DNC (Sections II and III) Date (MM/DD/YYYY) and time (HR:MM AM/PM): _____ <i>(Time of death is the time during the final apnea test [if more than one performed] that the ABG results are reported and demonstrate that the PaCO₂ and pH levels are consistent with BD/DNC criteria.)</i>
<input type="checkbox"/>	BRAIN DEATH/DEATH BY NEUROLOGIC CRITERIA DETERMINED WITH CLINICAL ASSESSMENT AND ANCILLARY TESTING <ul style="list-style-type: none"> Prerequisites for clinical testing have been fulfilled (Section I) and Results of clinical exams, including apnea testing, where tested are consistent with BD/DNC (Sections II and III) and Ancillary testing has been performed and results are consistent with BD/DNC (Section IV) Date (MM/DD/YYYY) and time (HR:MM AM/PM): _____ <i>(Time of death is the time an attending clinician [e.g., nuclear medicine physician or angiographer] documents in the medical record that the ancillary test results are consistent with BD/DNC criteria.)</i>
<input type="checkbox"/>	PATIENT DOES NOT MEET CRITERIA FOR BRAIN DEATH/DEATH BY NEUROLOGIC CRITERIA Provide reasons: _____
_____	_____
Attending name (printed)	Signature Date Time