Updated Brain Death Guidelines

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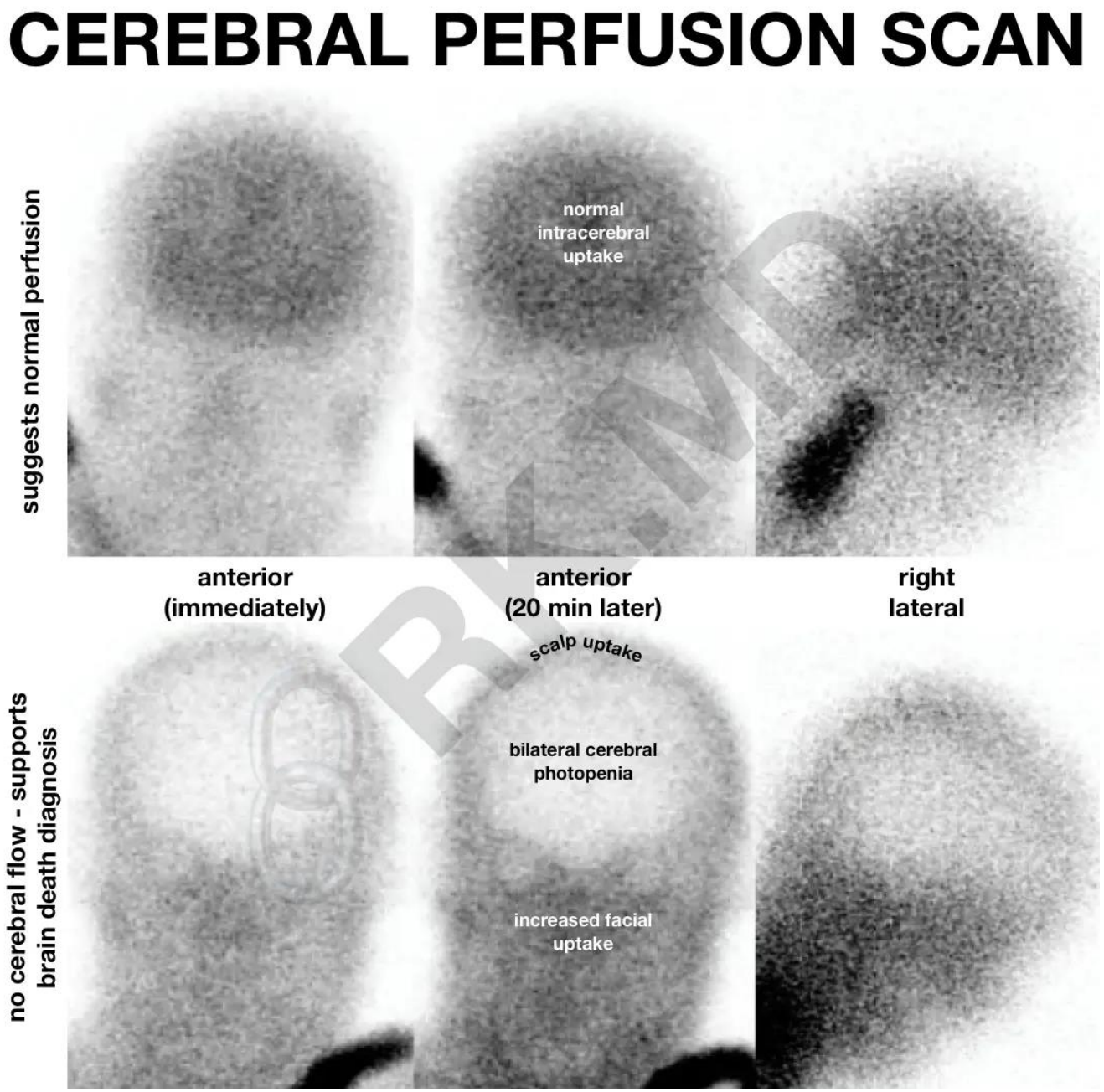
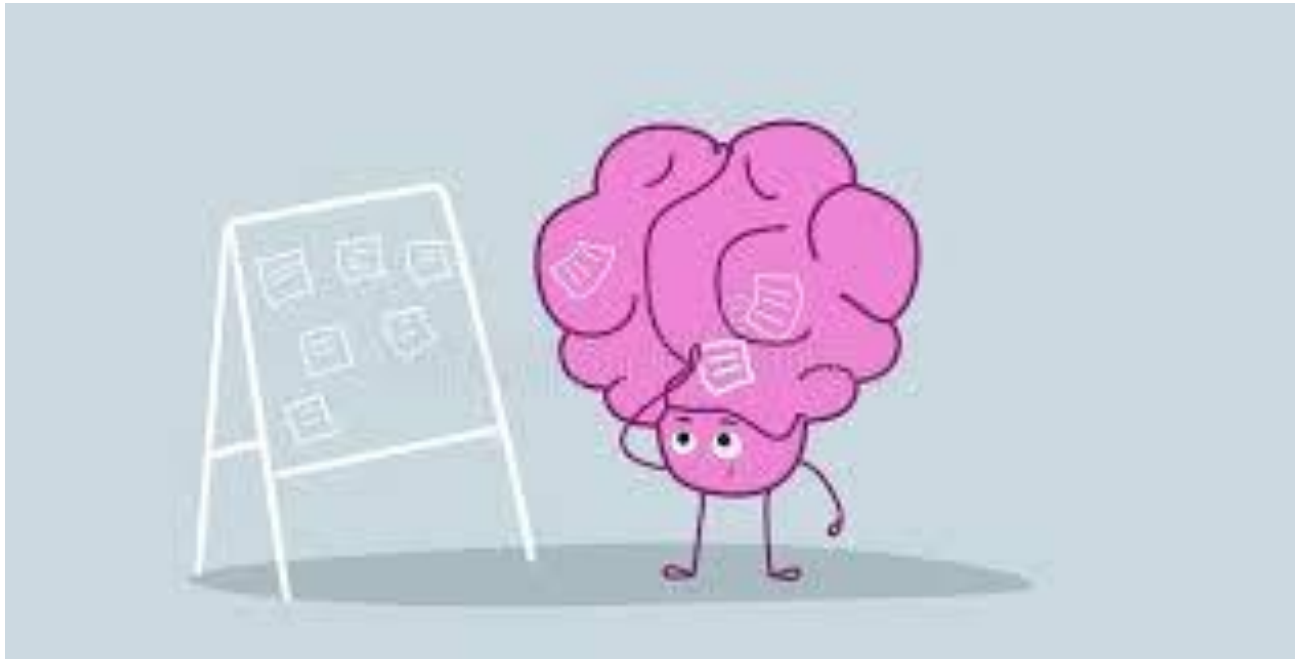
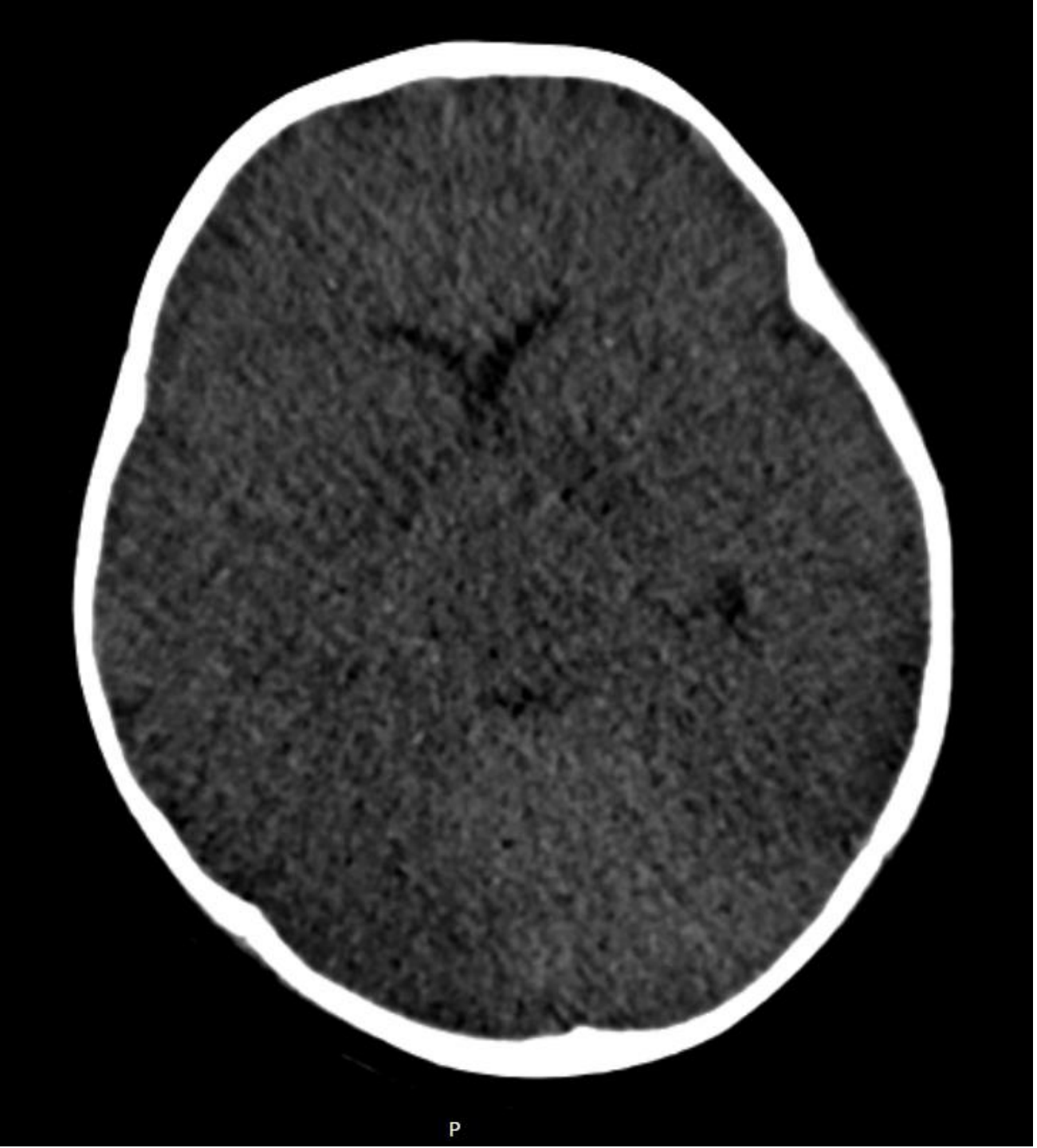


Objectives

- Review criteria for a patient to undergo brain death testing.
- Discuss barriers in performing brain death testing and apnea testing.
- Understand when to obtain ancillary testing and the timing of ancillary testing.
- Review ethical dilemmas with brain death testing.
- Present new workflow of documenting brain death testing.





9moF previously healthy admitted after being found down in the bathtub. She required >50 minutes of CPR prior to achieving ROSC.

- Initial Head CT: diffuse cerebral edema with effacement of sulci and crowding of basilar cisterns.
- She is warmed to 37C and maintained on a low dose epinephrine infusion with improvement in her hemodynamics.
- Her exam is concerning for absent pupillary, cough, and gag reflexes.

You are concerned that this patient has progressed to brain death due to her severe anoxic injury.

- Does this patient qualify for brain death testing?
- When are you able to perform the first brain death test in this patient?

Prerequisite Conditions

Age ≥ 37 wk corrected gestational age

Etiology of brain injury must be known

- Neuroimaging should be consistent with the mechanism and severity of brain injury
- Primary posterior fossa injury: ensure concurrent catastrophic supratentorial injury

Observe for sufficient time to determine the severity and permanency of the brain injury

- < 24 mo old: wait > 48 hr independent of brain injury etiology
- ≥ 24 mo old: wait > 24 hr after hypoxic-ischemic brain injury
- After medical or surgical interventions to treat intracranial hypertension, wait sufficient time to ensure no recovery of brain function

Core body temperature

- ≥ 36°C
- If temperature ≤ 35.5°C, wait >24 hr after rewarming to ≥ 36°C

Blood pressure

- Adults: SBP ≥ 100 mm Hg and MAP ≥ 75 mm Hg
- Children: SBP and MAP greater than or equal to fifth percentile for age
- VV ECMO: same as for non-ECMO
- VA ECMO: MAP ≥ 75 mm Hg (adults) or ≥ fifth percentile for age (children)

Toxicology

- Ensure toxicology (urine and blood) screening, if clinically indicated, is negative
- Alcohol blood level ≤ 80 mg/dL

Medications

- Confirm medication levels (when available) are in therapeutic or subtherapeutic range
- Allow at least five half-lives to pass
- Consider age-dependent metabolism
- Consider a longer elimination period if the patient has renal or hepatic dysfunction
- Consider a longer elimination period if the patient is obese or is hypothermic

Exclude severe metabolic, acid-base, and endocrine derangements

- Sodium: < 130 mmol/L or > 160 mmol/L
- Glucose: < 70 mg/dL or > 300 mg/dL
- Blood urea nitrogen: > 75 mg/dL
- Calcium (iCa): < 7 mg/dL or > 11 mg/dL (< 1 mmol/L or > 1.3 mmol/L)
- Magnesium: < 1.5 mg/dL or > 4 mg/dL
- pH: < 7.3 or > 7.5
- Total T4[a]: < 3 mg/dL or > 30 mg/dL; free T4[a]: ≤ 0.4 ng/dL or > 5 ng/dL
- Ammonia[a]: > 75 µmol/L

Back to our Case

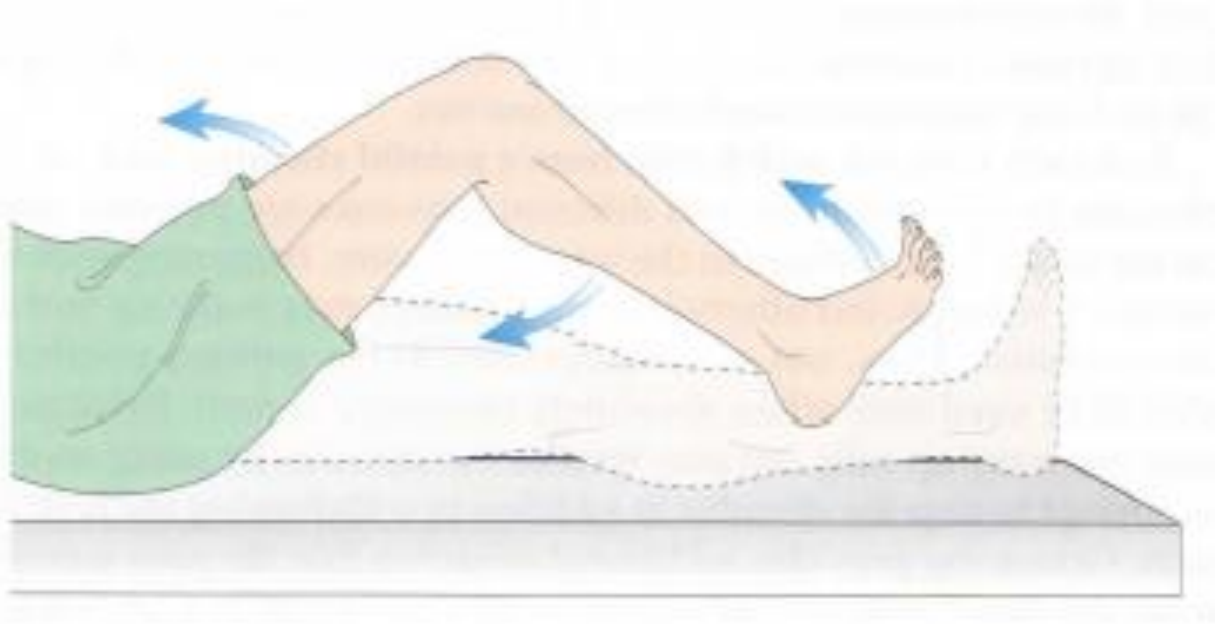
During the patient's initial brain death testing, the patient has flexion of the thigh, leg, and foot during noxious stimuli of the right lower extremity.

- What is this movement?
- Does this patient need ancillary testing?
  - No she does not

eTABLE 4. DESCRIBED SPINAL REFLEXES IN BD/DNC*

Reflex	Description
Decerebrate-type movements[27]	Spontaneous extension of the extremities
Extensor-like posturing[27]	Back arching to the left or right
Eyelid opening[27]	Opening of the eyelids after nipple stimulation
Fasciculation[e89]	Twitching of contiguous groups of muscle fibers
Head turning[27, e90-e92]	Intermittent head turning from side to side every 10-30 seconds with or without extension of the upper extremities
Hugging[27]	Flexion of the trunk and movement of the arms in a hugging-like manner
Lazarus sign[27, e89, e93-e98]	Bilateral arm flexion, shoulder adduction, and hand raising to chest, face, or endotracheal tube with dystonic posturing of the fingers
Limb elevation[27]	Raising of limbs off the bed
Myoclonus[e89]	Twitching or contraction of a muscle or group of muscles
Plantar response[e89]	Plantar flexion
Pronator-extension[e89]	Pronation and extension of the upper extremity
Respiratory-like movements[27]	Adduction of both shoulders followed by a slow cough-like movement
Repetitive leg movements[e99]	Slight flexion of the leg and foot
Thumbs Up sign[e100]	Isolated thumb extension
Triple flexion[e89]	Flexion of the thigh, leg, and foot
Undulating toe[27]	Slow flexion then extension of the toes

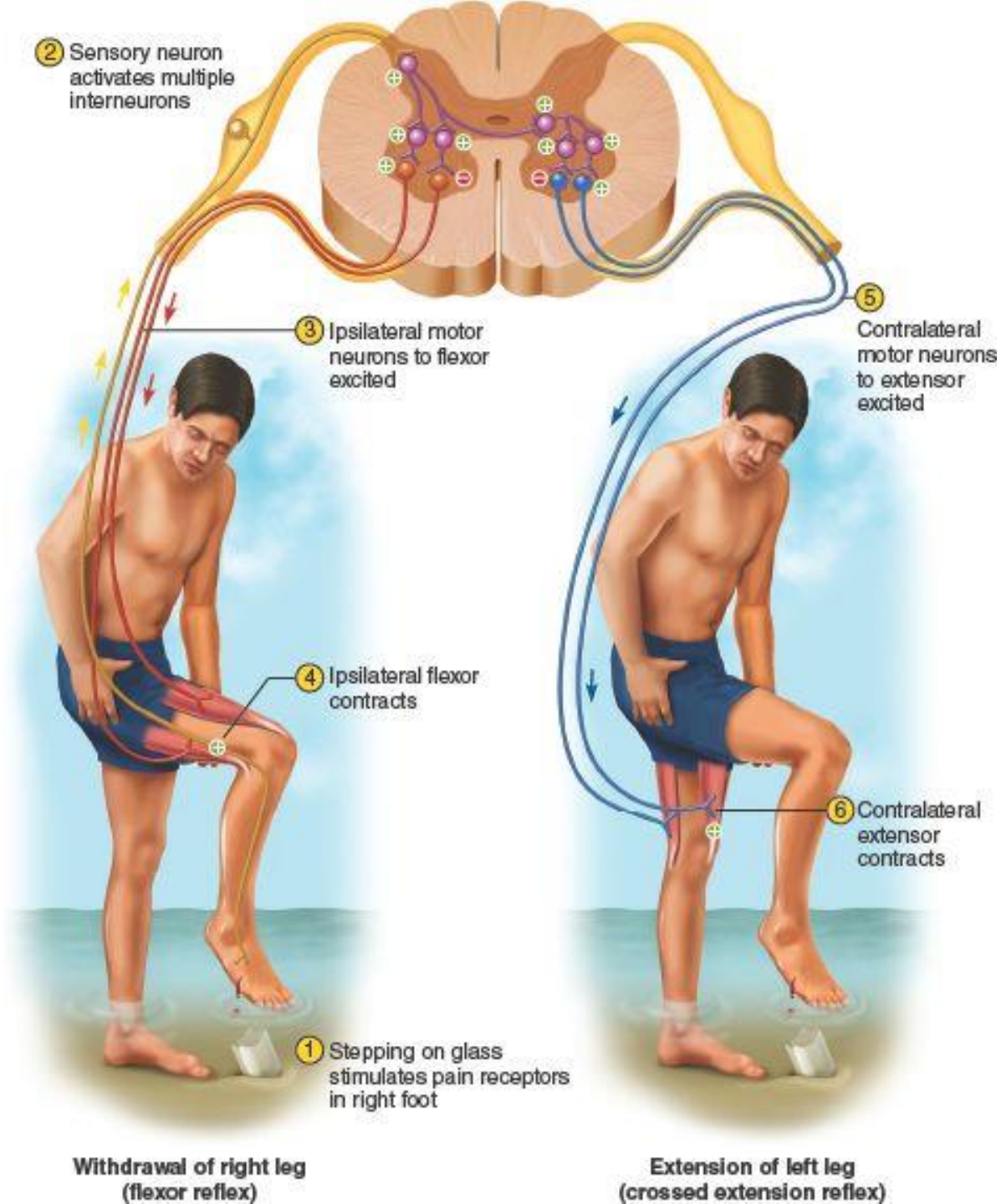
Spinal reflex versus purposeful withdrawal?



- Pinch the skin on the extensor and flexor sides of the limb and noting the direction of movement.
- Purposeful withdrawal should be **away from painful stimulus**.
- In flexor posturing the arm flexes even when the flexor side of the arm is pinched.
- **Reflexes can cross midline**

If it is unclear whether observed limb movements are spinally mediated, determination of BD/DNC should include an ancillary test.

Reflexes can cross midline



Back to Case 1

You have completed the initial portion of your patient's brain death testing and will now proceed to the apnea test.

- What are your steps in performing the apnea test in this patient?

eTABLE 5. CLINICAL GUIDANCE FOR PERFORMANCE OF THE APNEA TEST

Prerequisites

1. Ensure the patient is not hypercarbia, hypotensive, hypovolemic, or hypothermic
2. Determine if the patient has baseline CO_2 retention due to pre-existing disease and whether the baseline $Paco_2$ is known
   a. In a patient without known baseline CO_2 retention, adjust the ventilator to achieve a normal $Paco_2$ (35–45 mm Hg) and pH (7.35–7.45)

Prior to procedure

1. Preoxygenate for at least 10 minutes with 100% FIO_2, aiming for PaO_2 > 200 mm Hg
2. Check ABG to establish baseline pH, PaO_2, $PaCO_2$ within above parameters

Disconnect the patient from intermittent mandatory ventilation and provide apneic oxygenation

Techniques for providing apneic oxygenation

1. Tracheal insufflation for patients ≥18 years old
   a. Place a catheter inside the endotracheal or tracheostomy tube such that it approximately terminates just above the level of the carina.

The apnea test is consistent with BD/DNC if these conditions are met

1. No respirations or effort occurs, and
2. The arterial pH level is <7.30, and
3a. In patients who are known NOT TO HAVE chronic CO_2 retention, the $Paco_2$ level is ≥60 mm Hg AND ≥20 mm Hg above the patient's pre-apnea test baseline level.

   ii. Disable apnea alarm or lengthen to maximum allowable limit and assign provider to manually silence alarm
   iii. Remove all condensation from the inspiratory and expiratory limbs of ventilator circuit
   iv. Position the ventilator circuit away from the patient's body to allow for close examination of the chest and abdomen
   v. Adjust the trigger sensitivity to a level that avoids auto-triggering but is sensitive enough to detect a true spontaneous respiratory effort. Auto-triggering may falsely indicate a patient is initiating respiratory effort.

   d. T-piece resuscitator (e.g., Neopuff ventilator for infants)

These techniques may need modification in patients with communicable respiratory illness[e101,e102]

Case 2

15yoM admitted with a TBI after GSW to the head. He has significant facial trauma (including ocular) and refractory elevated ICPs requiring sedation, paralysis, and eventual pentobarbital infusions. Pentobarbital is discontinued for planned brain death testing.

- What are your considerations for brain death testing in this patient?

Toxicology

- Ensure toxicology (urine and blood) screening, if clinically indicated, is negative
- Alcohol blood level ≤ 80 mg/dL

Medications

- Confirm medication levels (when available) are in therapeutic or subtherapeutic range
- Allow at least five half-lives to pass
- Consider age-dependent metabolism
- Consider a longer elimination period if the patient has renal or hepatic dysfunction
- Consider a longer elimination period if the patient is obese or is hypothermic

Pentobarbital's half life is 26 ± 12 hours...
Confirm level (<5) or wait 3-8 days to pass

Have to consider other sedation and neuromuscular blockade.
PDF with half lives

Exclude severe metabolic, acid-base, and endocrine derangements

- Sodium: < 130 mmol/L or > 160 mmol/L
- Glucose: < 70 mg/dL or > 300 mg/dL
- Blood urea nitrogen: > 75 mg/dL
- Calcium (iCa): < 7 mg/dL or > 11 mg/dL (< 1 mmol/L or > 1.3 mmol/L)
- Magnesium: < 1.5 mg/dL or > 4 mg/dL
- pH: < 7.3 or > 7.5
- Total T4[a]: < 3 mg/dL or > 30 mg/dL; free T4[a]: ≤ 0.4 ng/dL or > 5 ng/dL
- Ammonia[a]: > 75 µmol/L

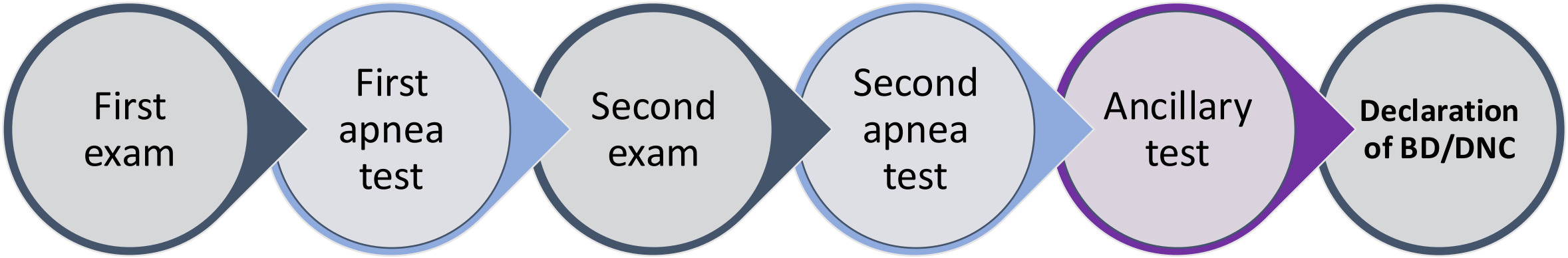
eTABLE 2. COMMON MEDICATIONS ADMINISTERED TO CRITICALLY ILL PATIENTS AND ESTIMATED HALF-LIVES[a]

Drug	Pharmacokinetics			Comments
Intravenous sedatives				
Dexmedetomidine[e32]	$t_{1/2}$	Infant ≤28d	3.2 hours	**Hepatic impairment** Compared to a baseline half-life of 2.5 hours in healthy adult patients, clearance in mild, moderate, and severe hepatic impairment was 3.9, 5.4, and 7.4 hours, respectively.[e33] Consider tapering rather than abrupt cessation for patients on >24 hours of therapy to avoid hemodynamic changes.
		Pediatric	<2 years: 2.3 hours 2–11 years: 1.6 hours	
		Adult	~3 hours	
	Metabolism		Hepatic	
	Excretion		Urine (95%)	
Etomidate[e34]	$t_{1/2}$	Infant ≤28d	2.6–3.5 hours	**Continuous infusion:** Plasma terminal half-life was found to be ~5.5 hours when administered as a continuous infusion.[e35] **Hepatic impairment:** In patients with cirrhosis, the terminal half-life of continuous infusion can be prolonged up to 2-fold (~9 hours).[e36]
		Pediatric		
		Adult		
	Metabolism		Hepatic; plasma esterases	
	Excretion		Urine (~75%), bile (10%)	
Ketamine[e37, e38]	$t_{1/2}$	Infant ≤28d	~2.5 hours	
		Pediatric[e39]		
		Adult		
	Metabolism		Hepatic	
	Excretion		Urine (91%)	
Midazolam[e40,b]	$t_{1/2}$	Infant ≤28d	4–12 hours	**Renal impairment:** With continuous infusions, half-life of the parent compound can increase up to 2-fold. Half-life of the active metabolite can increase significantly compared to control group.[e41] **Special populations with prolonged half-lives**: • Elderly: Increased 2-fold • Heart failure: Increased 2-fold • Hepatic impairment: Increased 2.5-fold
		Pediatric	2.9-4.5 hours	
		Adult	~3 hours	
	Metabolism		Hepatic	

Due to this patient's facial injuries...

Indications for Ancillary Testing
Ancillary testing should be used in the following situations
Injuries or abnormalities preclude accurate assessment of any component of the neurologic examination (with the notable exception of the oculocephalic reflex in the setting of cervical spine instability, provided the oculovestibular reflex can still be tested)
Inability to perform or complete the apnea test safely because of the patient's risk of cardiac or pulmonary decompensation
Inability to interpret $Paco_2$ levels in a patient with chronic hypercarbia for whom the chronic baseline $Paco_2$ level is unknown
Findings on neurologic examination that may be difficult to interpret, such as limb movements that may or may not be spinally mediated
Metabolic derangements unable to be adequately corrected

Ancillary testing… New timeline!



Case 3

9yoM presented as a level 1 trauma after a sledding accident. His initial head CT demonstrated bilateral atlanto-occipital dissociation, subarachnoid hemorrhage in basilar cisterns and 4th ventricle, and likely cerebral edema. On HD 2, he lost his pupillary reflex and EEG demonstrated no activity.

☐ 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.)* (14a) Reason(s) for incomplete testing (check all that apply):

☐ Anophthalmia; ☐ Corneal trauma or transplantation; ☐ Fracture of the base of the skull or petrous temporal bone; ☐ High cervical cord injury

☐ Ophthalmic surgery that influences pupillary reactivity; ☐ Severe facial trauma; ☐ Severe pre-existing neuromuscular disorder

☐ Severe orbital or scleral edema or chemosis; ☐ Limb movements that may be spinally mediated; ☐ Other (specify):

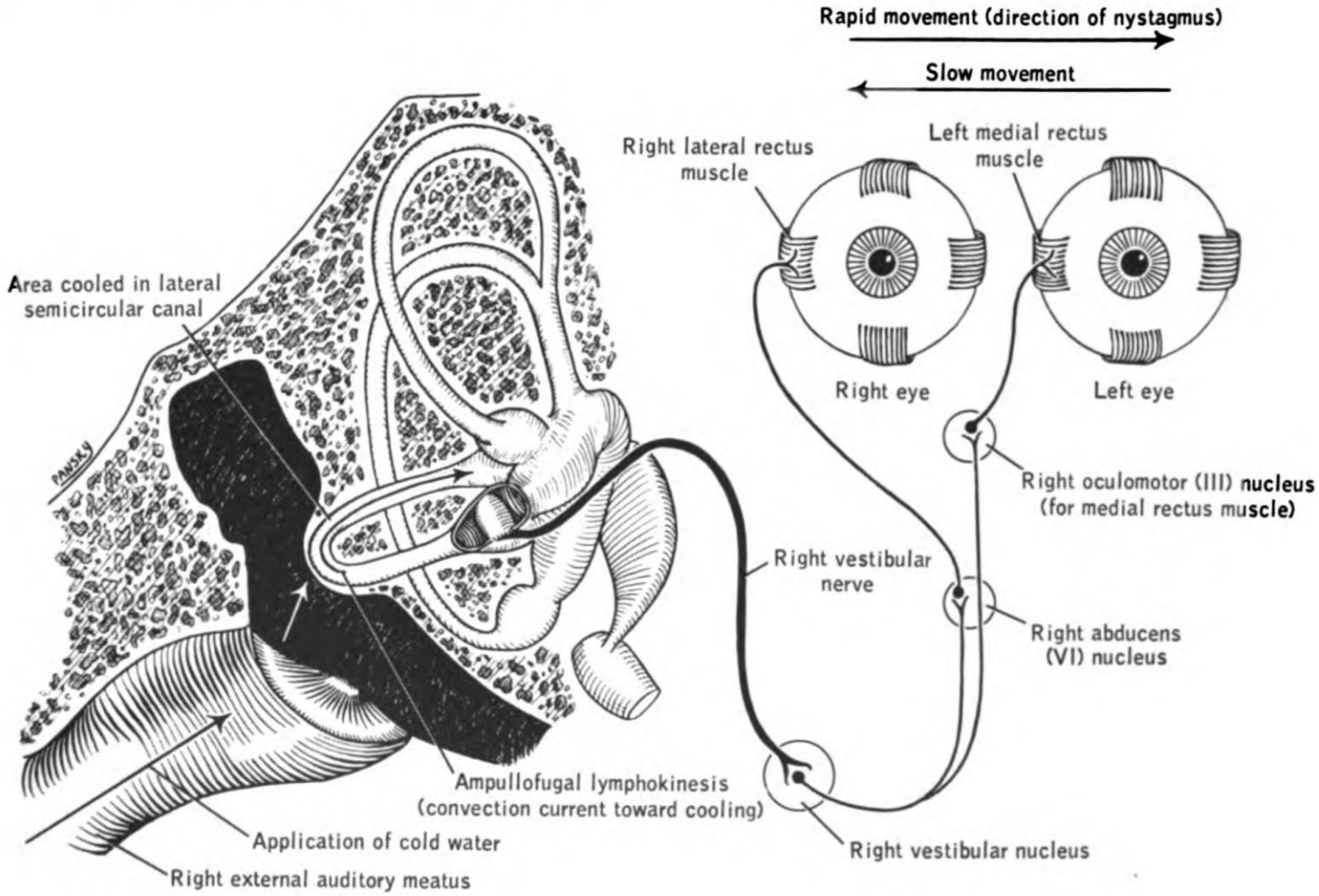
Oculocephalic versus Oculovestibular reflex:

Recommendations: Oculocephalic Reflex (OCR) vs Oculovestibular Reflex (OVR)

- Clinicians must determine that there is no OCR
  - Unless there is concern for cervical spine or skull base integrity.
- If the OCR is absent bilaterally or if the OCR cannot be tested, **OVR must be performed bilaterally.**
  - So that means we should always be testing both OCR and OVR if possible.
- If the OCR cannot be tested:
  - Clinicians may diagnose BD/DNC without ancillary testing provided that the OVR can be tested and is absent bilaterally and all other BD/DNC criteria are satisfied.

OCR and OVR Test the Same Cranial Nerves

- OCR can be harmful with C-spine injury or absence of skull base integrity
- OVR provides a stronger vestibular stimulus
  - May be a more sensitive test
- OVR – can be done incorrectly:
  - Examine auditory canals for patency and intact TMs
  - Elevate head to 30° to place horizontal semicircular canals in optimal orientation
  - Using a catheter attached to a syringe placed inside one of the auditory canals
    - Irrigate 50–60mL of ice water
    - For at least 60 seconds
    - Observe for extraocular movements
  - There should be a >5-min interval before testing opposite side to allow endolymph temperature to equilibrate



Back to our case!

The first brain death test is performed and is consistent with brain death.

Father refuses second brain death exam.

- How do you proceed?
- Do you need consent to perform the second brain death test?
  - No.

Death by BD/DNC criteria is equivalent medicolegally to death by cardiopulmonary criteria

- Clinicians **do not need to obtain consent** before an evaluation for BD/DNC
  - Unless otherwise stipulated by the institution's policy or state laws or regulations.
- Clinicians should make a reasonable attempt to inform the patient's family of the plan to perform a BD/DNC examination.
- Clinicians should provide the option for the family to observe the clinical evaluation, including apnea testing.
  - Clinicians should inform families that patients may have reflexive movements originating from:
    - The spinal cord
    - Muscles
    - Nerves
  - These movements do not preclude determination of BD/DNC.

Case 4

5yoF presents after an MVC. She had multiple cardiac arrests prior to arrival and required an ex-lap due to abdominal trauma with significant bleeding requiring MTP. She developed TRALI with need for the oscillator and has had continued hemodynamic instability with 3 vasoactive infusions.

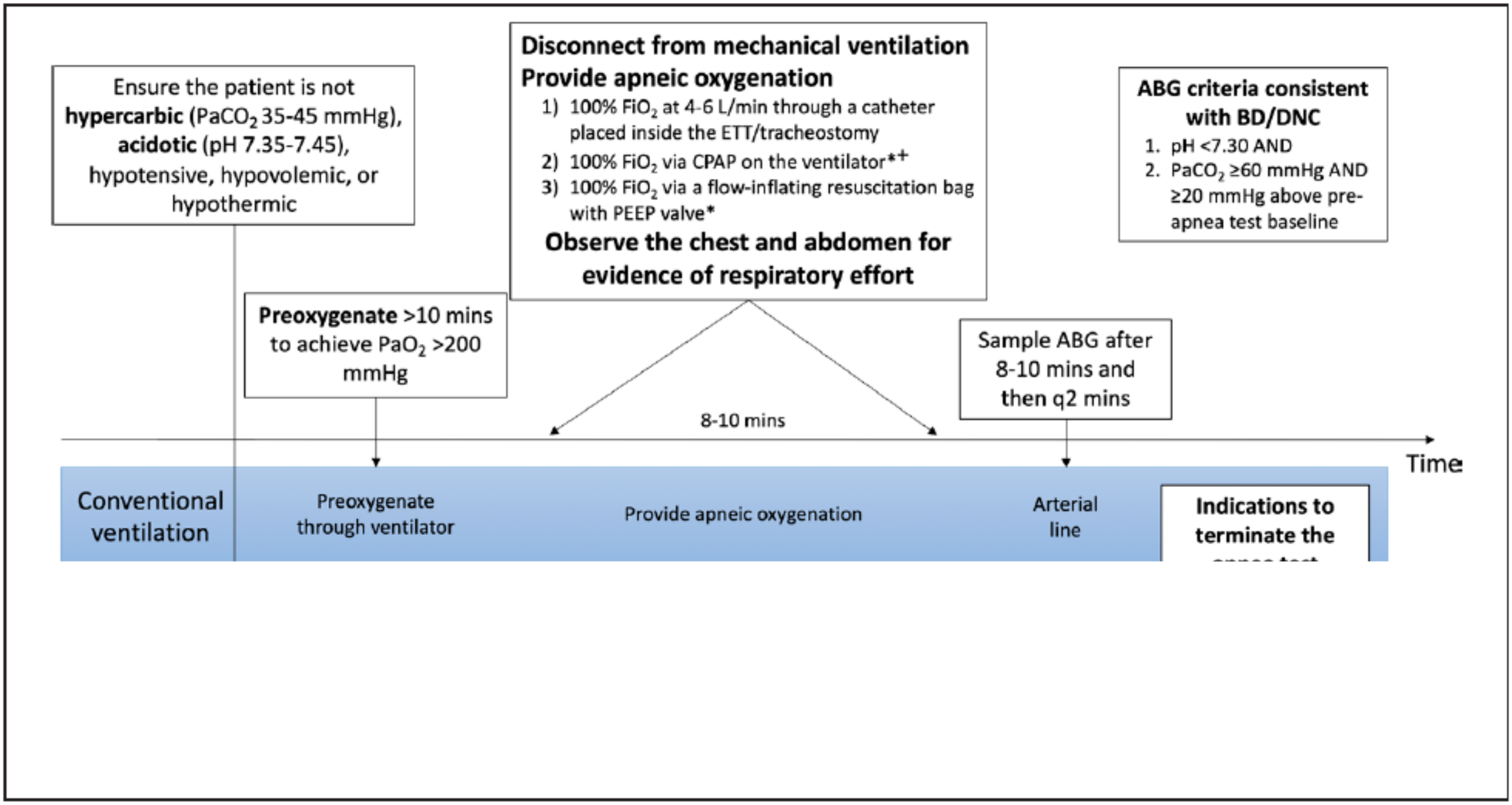
- She develops bilateral fixed and dilated pupils
- CT head reveals loss of grey/white differentiation, effacement of all ventricles, and concern for tonsillar herniation.
- Her vasoactive support includes epinephrine 0.3 mcg/kg/min, norepinephrine 0.2 mcg/kg/min, and vasopressin of 0.02 units/kg/hr.
- Family has opted to proceed with brain death testing of their child.
    - What are your considerations for brain death testing in this patient?

Indications for Ancillary Testing

Ancillary testing should be used in the following situations

- Injuries or abnormalities preclude accurate assessment of any component of the neurologic examination (with the notable exception of the oculocephalic reflex in the setting of cervical spine instability, provided the oculovestibular reflex can still be tested)
- Inability to perform or complete the apnea test safely because of the patient's risk of cardiac or pulmonary decompensation
- Inability to interpret $Paco_2$ levels in a patient with chronic hypercarbia for whom the chronic baseline $Paco_2$ level is unknown
- Findings on neurologic examination that may be difficult to interpret, such as limb movements that may or may not be spinally mediated
- Metabolic derangements unable to be adequately corrected

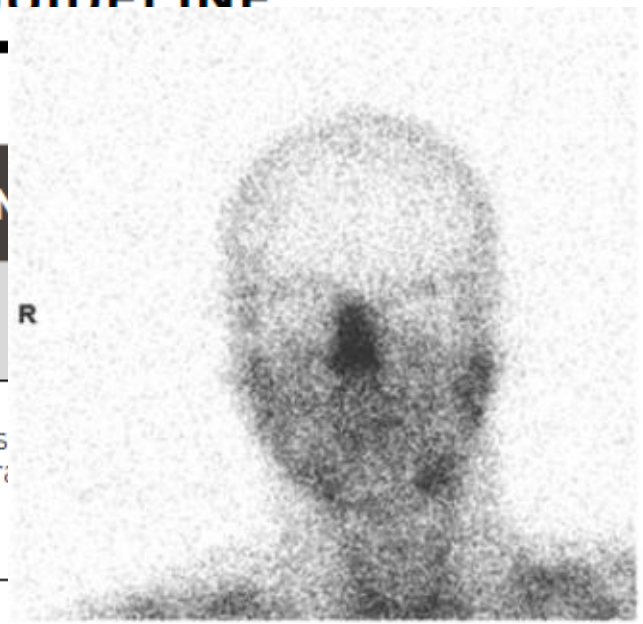
But the guidelines state that both apnea tests should still be attempted.

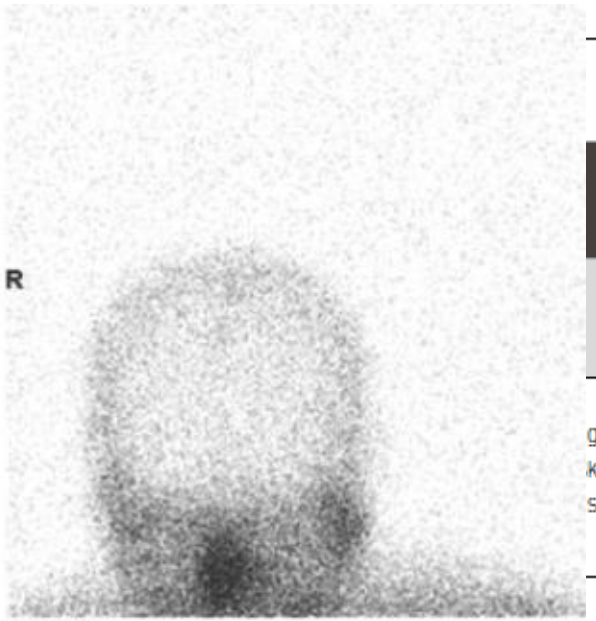

Ensure the patient is not **hypercarbic** ($PaCO_2$ 35-45 mmHg), **acidotic** (pH 7.35-7.45), hypotensive, hypovolemic, or hypothermic
Disconnect from mechanical ventilation
Provide apneic oxygenation
1) 100% FiO_2 at 4-6 L/min through a catheter placed inside the ETT/tracheostomy
2) 100% FiO_2 via CPAP on the ventilator*+
3) 100% FiO_2 via a flow-inflating resuscitation bag with PEEP valve*
Observe the chest and abdomen for evidence of respiratory effort
ABG criteria consistent with BD/DNC
1. pH <7.30 AND
2. $PaCO_2$ ≥60 mmHg AND ≥20 mmHg above pre-apnea test baseline
Preoxygenate >10 mins to achieve PaO_2 >200 mmHg
8-10 mins
Sample ABG after 8-10 mins and then q2 mins
Time
Conventional ventilation
Preoxygenate through ventilator
Provide apneic oxygenation
Arterial line
Indications to terminate the

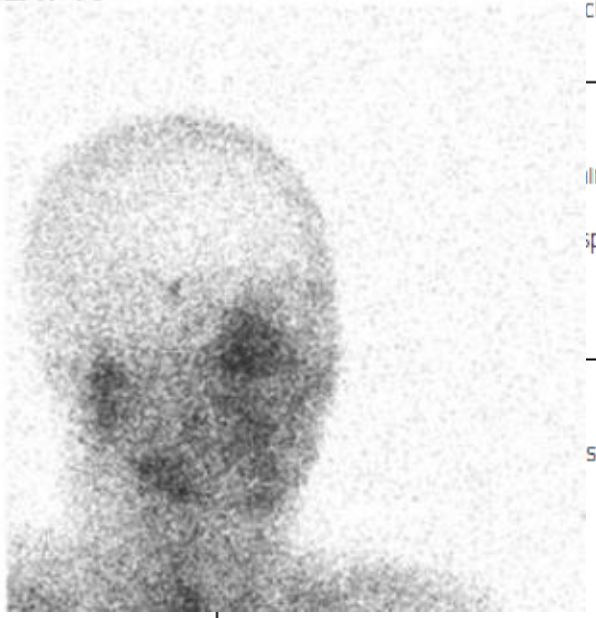
2023 BRAIN DEATH GUIDELINE

eTABLE 6. ANCILLARY TESTIN

Test		Sensitivity/specificity
Digital subtraction angiography /conventional 4-vessel angiography	Abs intra	100%/ 100%[a, e103, e104]
Radionuclide angiography	Abs ima	98.5%/56%[e105]
Radionuclide perfusion scintigraphy	Abs indi ima	Planar: 77.8%/100% SPECT: 88.4%/100%[a, e106]
	Rec spik dias intra or p sign	90%/98%[59]







This is the test we use!

Case 5

5yoF with history of VP shunt, seizures, chronic respiratory insufficiency with nighttime BiPAP develops progressive lethargy and abnormal breathing that leads to cardiac arrest requiring CPR enroute to the ED.

- Upon arrival to the ED, she has fixed and dilated pupils with no corneal, cough, or gag reflexes.
- CT head performed which was concerning for shunt malfunction with brainstem compression and was taken to the OR for shunt revision.
- Unfortunately, despite revision, she continues to have loss of brainstem reflexes.
- She is also visiting from out of town, and you do not have access to her baseline pCO_2 levels (known to be high).
    - What are your considerations with regards to the apnea testing for this patient?

Indications for Ancillary Testing

Ancillary testing should be used in the following situations

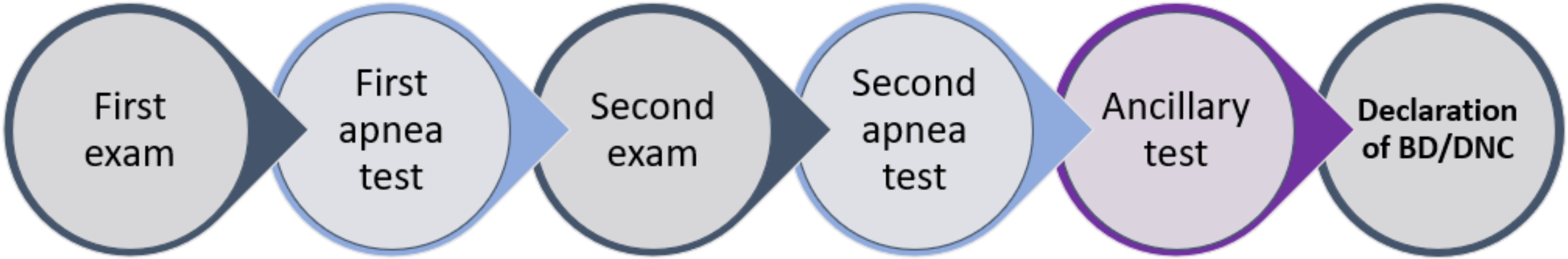
- Injuries or abnormalities preclude accurate assessment of any component of the neurologic examination (with the notable exception of the oculocephalic reflex in the setting of cervical spine instability, provided the oculovestibular reflex can still be tested)
- Inability to perform or complete the apnea test safely because of the patient's risk of cardiac or pulmonary decompensation
- Inability to interpret $Paco_2$ levels in a patient with chronic hypercarbia for whom the chronic baseline $Paco_2$ level is unknown
- Findings on neurologic examination that may be difficult to interpret, such as limb movements that may or may not be spinally mediated
- Metabolic derangements unable to be adequately corrected

CO_2 Goals for Apnea Testing

Patient does NOT have chronic CO_2 retention	In patients who are KNOWN TO HAVE chronic CO_2 retention, and the baseline $PaCO_2$ is KNOWN	In patients who are SUSPECTED TO HAVE chronic CO_2 retention, but the baseline $PaCO_2$ is UNKNOWN
• $PaCO_2$ level is ≥60 mmHg • AND ≥20 mmHg above the patient's pre-apnea test baseline level	• $PaCO_2$ level is ≥60 mmHg • AND ≥20 mmHg **above the patient's known chronic elevated premorbid baseline level.**	• $PaCO_2$ level is ≥60 mmHg • AND ≥20 mmHg above the patient's pre-apnea test level • **AND an ancillary test is required.**

Other Ancillary Testing Recommendations:

- Do not use ancillary testing in setting of:
  - Hypothermia
  - High-levels of sedation
  - To avoid performing otherwise testable elements of BD/DNC assessment
- If ancillary testing is needed, both examinations and apnea tests need to be as fully performed as possible prior to ancillary testing.
- In patients who meet clinical criteria for BD/DNC, clinicians should **not** perform



4wkM 38wk gestation HLHS s/p Norwood/Sano 3 days ago. Came out of the OR on VA-ECMO due to difficulty separating from bypass. Overnight last night, right pupil became dilated and nonreactive. 3% is pushed and code stroke is called.

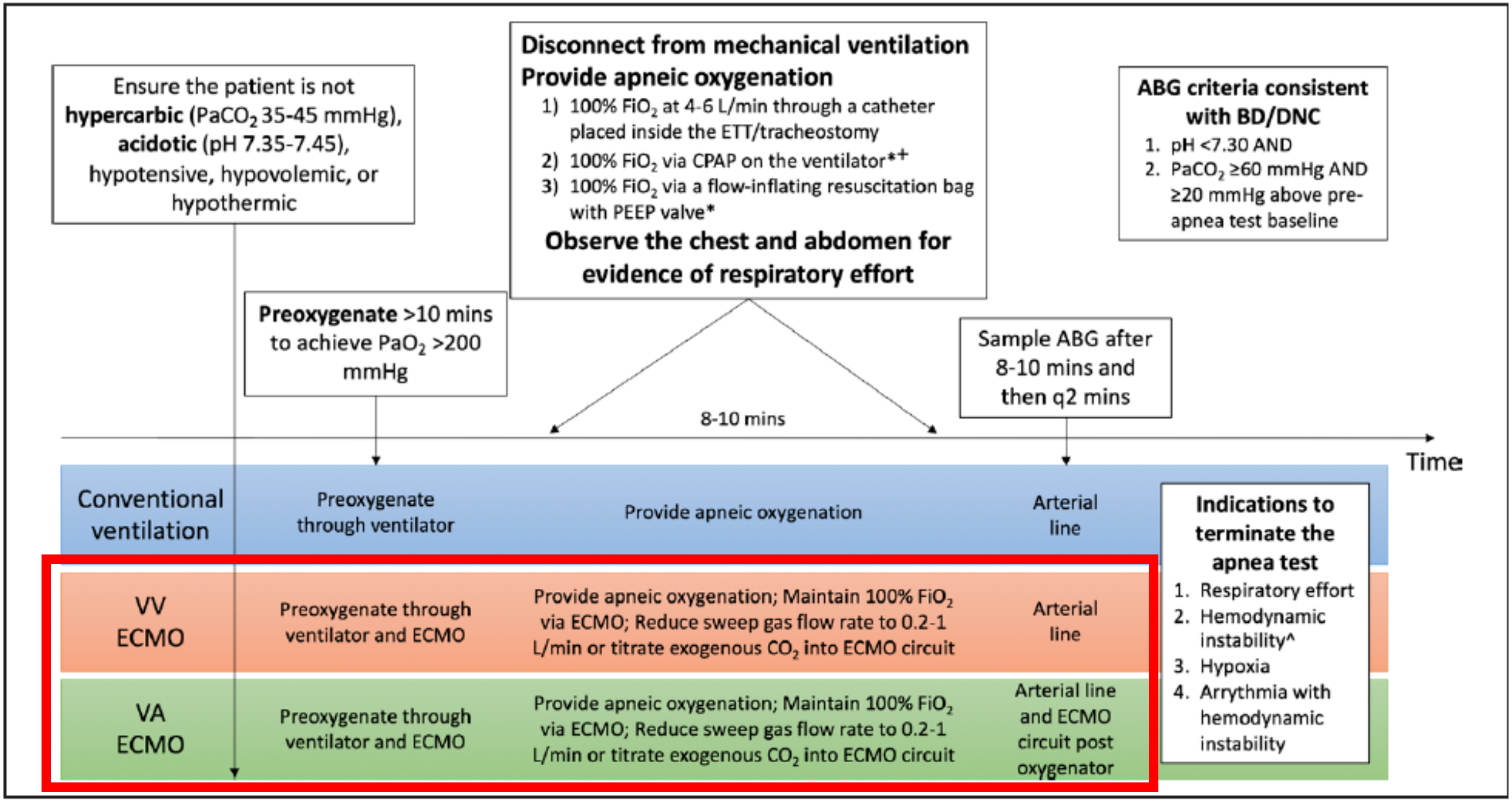
- CT head demonstrates a large interventricular and intraparenchymal bleed, effacement of the ventricles and sulci, and transtentorial and uncal herniation.
- Upon return to the unit, the second pupil is nonreactive and patient has lost cough, gag, and corneal reflexes.
- All sedative drips are stopped. Patient remains without any brainstem reflexes on exam.
- Parents ask about organ donation.
  - Can he undergo brain death testing on VA ECMO?
  - What are your considerations with regards to the apnea testing for this patient?
  - Why did we mention gestational age?

Brain death testing on ECMO

It’s possible!

Apnea testing on ECMO in general

1. Preoxygenate
   - Using 100% FiO_2 on the ventilator
   - And through 100% FiO_2 with the membrane lung
2. To achieve an adequate increase in $PaCO_2$ level:
   - Titrate exogenous CO_2 into the ECMO circuit
   - Or adjust the sweep gas flow rate down
3. VA-ECMO: obtain ABG measurements from **both** the patient's A-line and the ECMO circuit post-oxygenator
4. Avoid hypotension during apnea testing on ECMO by increasing ECMO flows, IV fluid administration, or vasopressor/ionotropic support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2. $PaCO_2$ ≥60 mmHg AND ≥20 mmHg above pre-apnea test baseline
Preoxygenate >10 mins to achieve PaO_2 >200 mmHg
8-10 mins
Sample ABG after 8-10 mins and then q2 mins
Time
Conventional ventilation
Preoxygenate through ventilator
Provide apneic oxygenation
Arterial line
VV ECMO
Preoxygenate through ventilator and ECMO
Provide apneic oxygenation; Maintain 100% FiO_2 via ECMO; Reduce sweep gas flow rate to 0.2-1 L/min or titrate exogenous CO_2 into ECMO circuit
Arterial line
VA ECMO
Preoxygenate through ventilator and ECMO
Provide apneic oxygenation; Maintain 100% FiO_2 via ECMO; Reduce sweep gas flow rate to 0.2-1 L/min or titrate exogenous CO_2 into ECMO circuit
Arterial line and ECMO circuit post oxygenator
Indications to terminate the apnea test
1. Respiratory effort
2. Hemodynamic instability^
3. Hypoxia
4. Arrythmia with hemodynamic instability

So we have completed one test…. How long do we wait between tests?

Pediatrics

- Two clinicians must each perform a separate and independent examination for BD/DNC.
- A **minimum interval of 12 hours** should separate the two examinations in pediatrics.

Adults

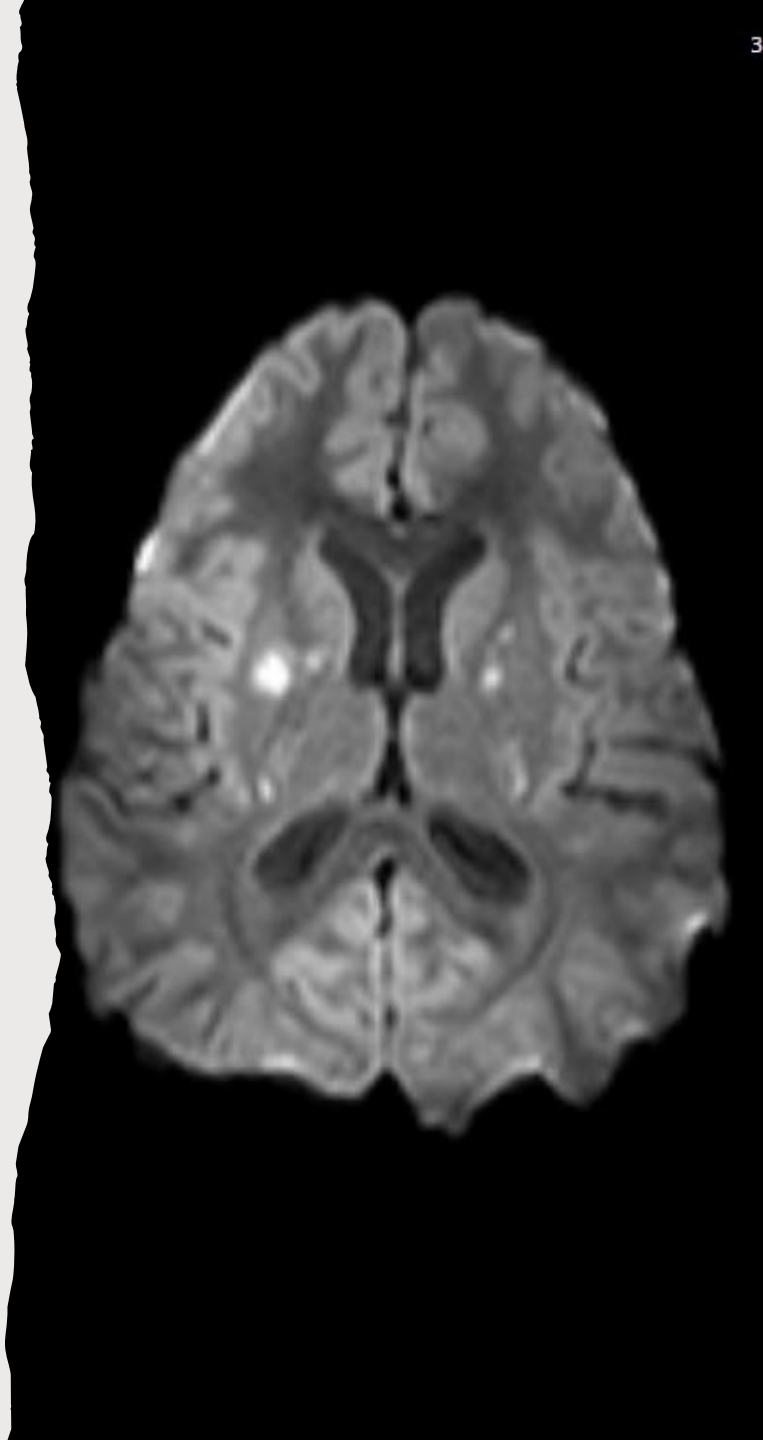
- Clinicians must perform a **minimum of 1 examination** for BD/DNC
- Second clinician may perform a separate and independent examination for BD/DNC
  - Performance of 2 independent BD/DNC examinations may decrease the risk of a false-positive determination due to diagnostic error.

5yoM who couldn’t be woken up after a nap. Intubated in the ED for concern for depressed mental status and seizure-like activity.

- Head CT demonstrates markedly abnormal and edematous appearing cerebellar hemispheres
- Repeat head CT 9 hours later shows worsening obstructive hydrocephalus.
- HD2: Goes for decompressive craniectomy and EVD. ICPs are exceedingly difficult to control. Later that day, pupils become nonreactive.
- Soon corneal, cough, and gag reflexes are also lost.
  - Can this patient undergo brain death testing?
  - When can this patient undergo brain death testing?

Primary Posterior Fossa Process

- Patients may appear clinically comatose:
  - Brainstem areflexia
  - Apnea
  - **However, they may retain some cortical function**
- Clinicians should ensure that the posterior fossa process ***has also led to catastrophic supratentorial injury***
  - Injury should be demonstrated on a conventional neuroimaging study <u>before</u> initiating the BD/DNC evaluation



Time of Death?

- Typical pediatric testing:
  - Time of death = timing of last ABG during apnea test
- With ancillary testing:
  - Time of death = the time an attending clinician documents in the EMR that the ancillary test results are consistent with BD/DNC

Check the Checklist for Specifics!

- Available in appendix
- Contains many of the special considerations we discussed.

After this talk, we will share a file folder that has this presentation, all the literature, and all the appendices.

eAppendix 5. Brain Death/Death by Neurologic Criteria Checklist

Last Name	First name	DOB	MRN

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 brain death/death by neurologic criteria (BD/DNC) (7a and 13a)	☐ Yes ☐ No Etiology:
2. Neuroimaging consistent with mechanism and severity of brain injury (in patients with primary posterior fossa injury, neuroimaging should demonstrate catastrophic supratentorial injury) (7c and 40)	☐ Yes ☐ No
3. Observation for permanency a) ≥48 hours after acute brain injury (particularly hypoxic ischemic brain injury) for patients ≤2-years-old (8) b) ≥24 hours after hypoxic ischemic brain injury for patients ≥2-years-old (9b) 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 (9a)	☐ Yes ☐ No Observation period (hours):
4. Core body temperature ≥ 36°C (for ≥24 hours for patients whose core body temperature has been ≤35.5°C [10a and b])	☐ Yes ☐ No Value:
5. Systolic blood pressure (SBP) ≥ 100 mm Hg and mean arterial pressure (MAP) ≥ 75 mm Hg for adults/SBP and MAP ≥ 5th percentile for age in children (for patients on venoarterial ECMO: MAP ≥ 75 mm Hg for adults/MAP ≥ 5th percentile for age in children) (11b and 11c)	☐ Yes ☐ No Value:
6. Exclusion of pharmacologic paralysis (if administered or suspected) through use of train-of-four stimulator or demonstration of deep tendon reflexes (12a)	☐ Yes ☐ No ☐ Not indicated
7. Drug levels for medications that may suppress central nervous system function are therapeutic/subtherapeutic (if available), 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); (12a)	☐ Yes ☐ No
8. Alcohol blood level ≤ 80 mg/dL (if clinically indicated) (12a)	☐ Yes ☐ No ☐ Not indicated
9. Toxicology screen (urine and blood) is negative (if clinically indicated) (12a)	☐ Yes ☐ No ☐ Not indicated
10. Exclusion of severe metabolic, acid-base, and endocrine derangements; (12a)	☐ Yes ☐ No
11. A reasonable attempt has been made to inform the patient's family of the plan to perform a BD/DNC examination (35a)	☐ Yes ☐ No
Prerequisite Summary (check one):	
☐ All prerequisites were met	
☐ Unable to adequately correct metabolic derangements, but all other prerequisites were met, so will complete the neurologic examinations and apnea test(s) and if they are consistent with BD/DNC, will perform ancillary testing (12b)	

Citations

- Triple Flexion: https://telegra.ph/Oglyad-pac%D1%96yenta-v-kom%D1%96-05-25
- Hot nose sign: https://radiopaedia.org/articles/cerebral-oedema-summary?lang=us
- OVR Diagram: https://en.wikipedia.org/wiki/Caloric_reflex_test

BRAIN DEATH DOCUMENTATION 2024 GUIDELINES

NEW NOTE GOES LIVE APRIL 3RD

DANIEL BARRETT DNP

THIS UPDATE…

DOES

- Give the providers a uniform documentation tool
- Save time and reduce confusion

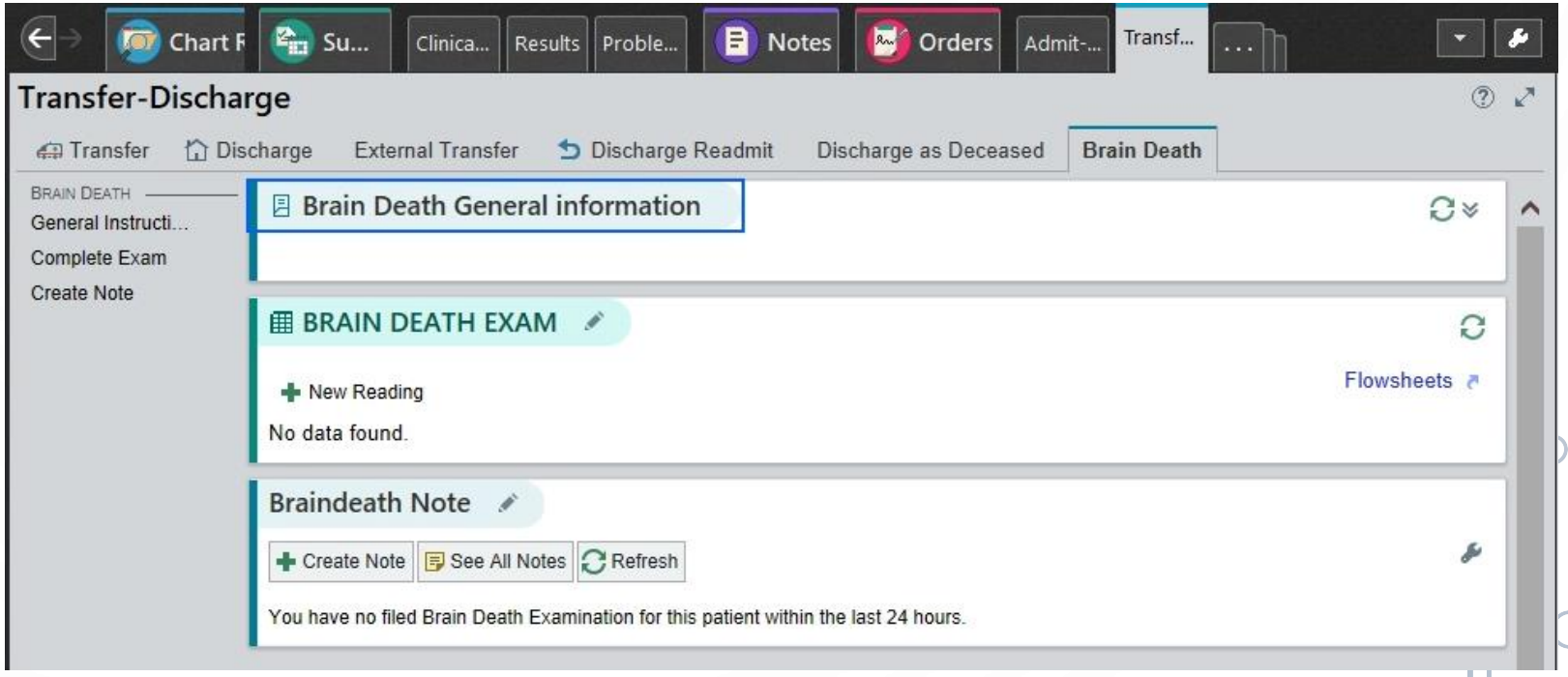
DOES NOT

- Teach a brain death exam
- Substitute for clinical judgement
- Relinquish legal responsibility for the individual provider on performance or changes

GETTING STARTED

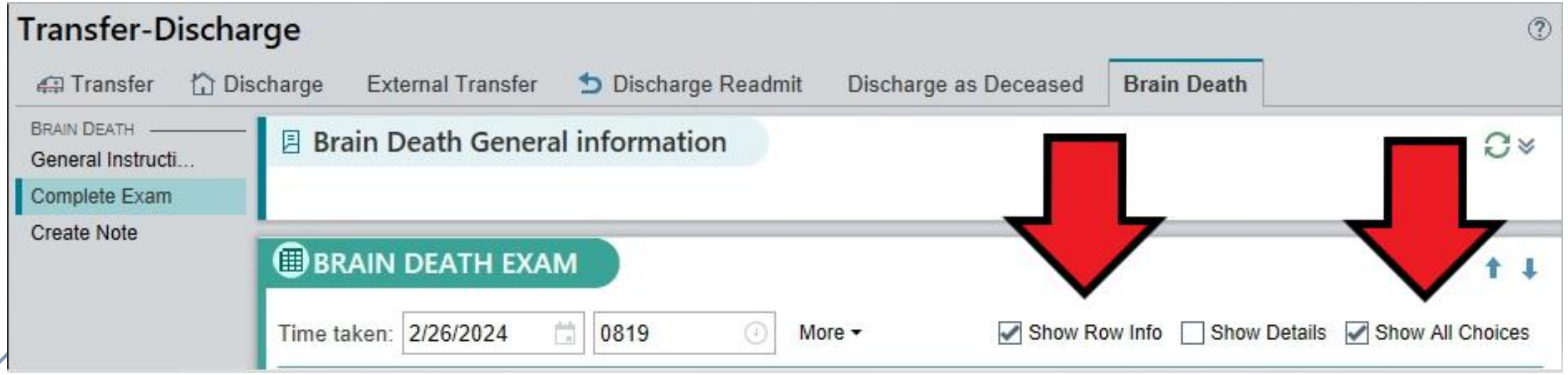
- Documentation tool remains in the “Transfer-Discharge” navigator
- Security to access is based on the department and specialty of the individual user (critical care, anesthesia, neurology, neurosurgery, trauma surgery)

- **Three-part navigator**
  - General instructions
  - Complete Exam
  - Create Note



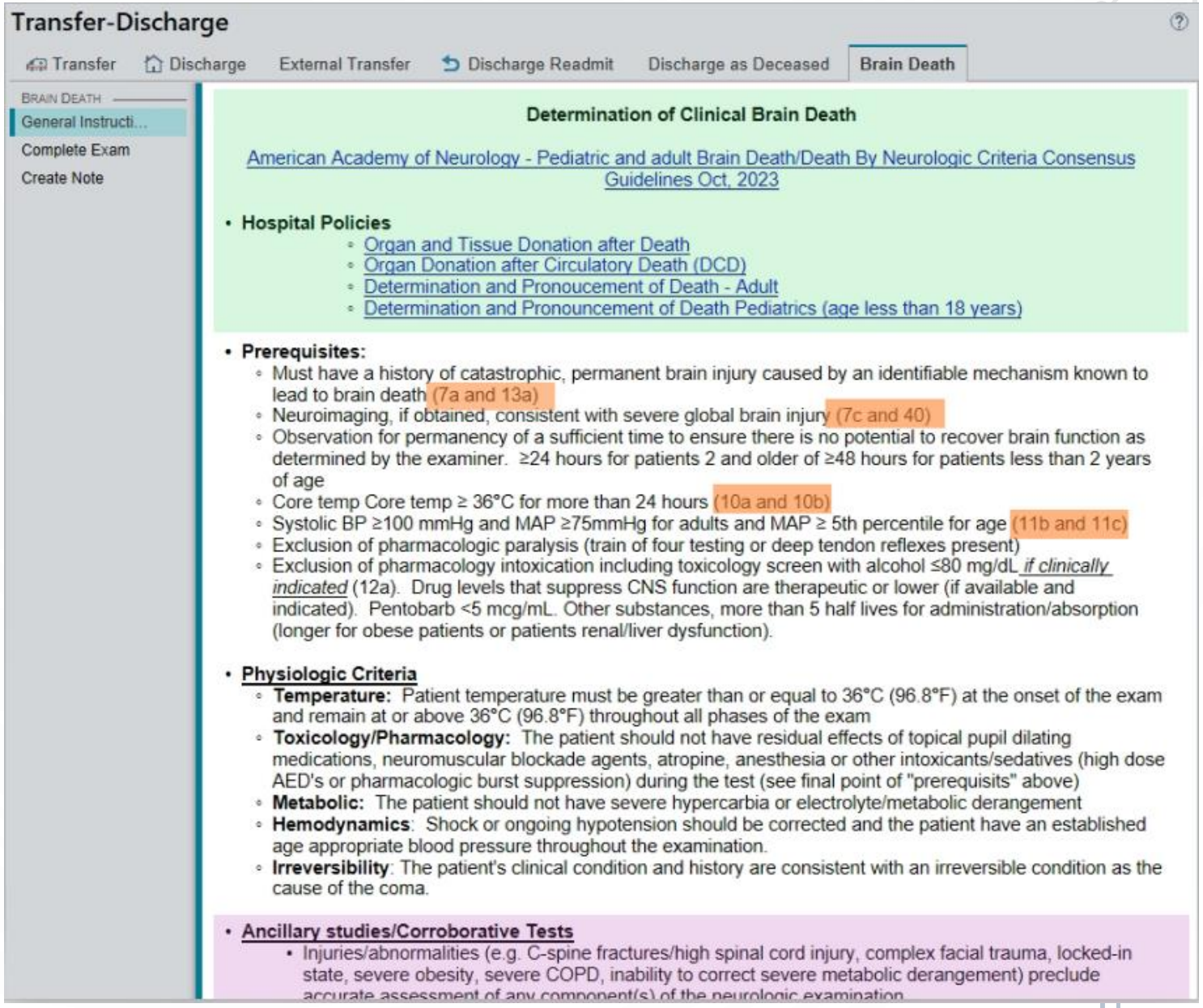
GETTING STARTED – NAVIGATOR FUNCTION

- At the top of all navigators, there are options to "**Show Row Information**" and "**Show All Choices**"
- Make sure <u>both of these</u> boxes are checked
- Provides you with critical information, reminders, and all available documentation options



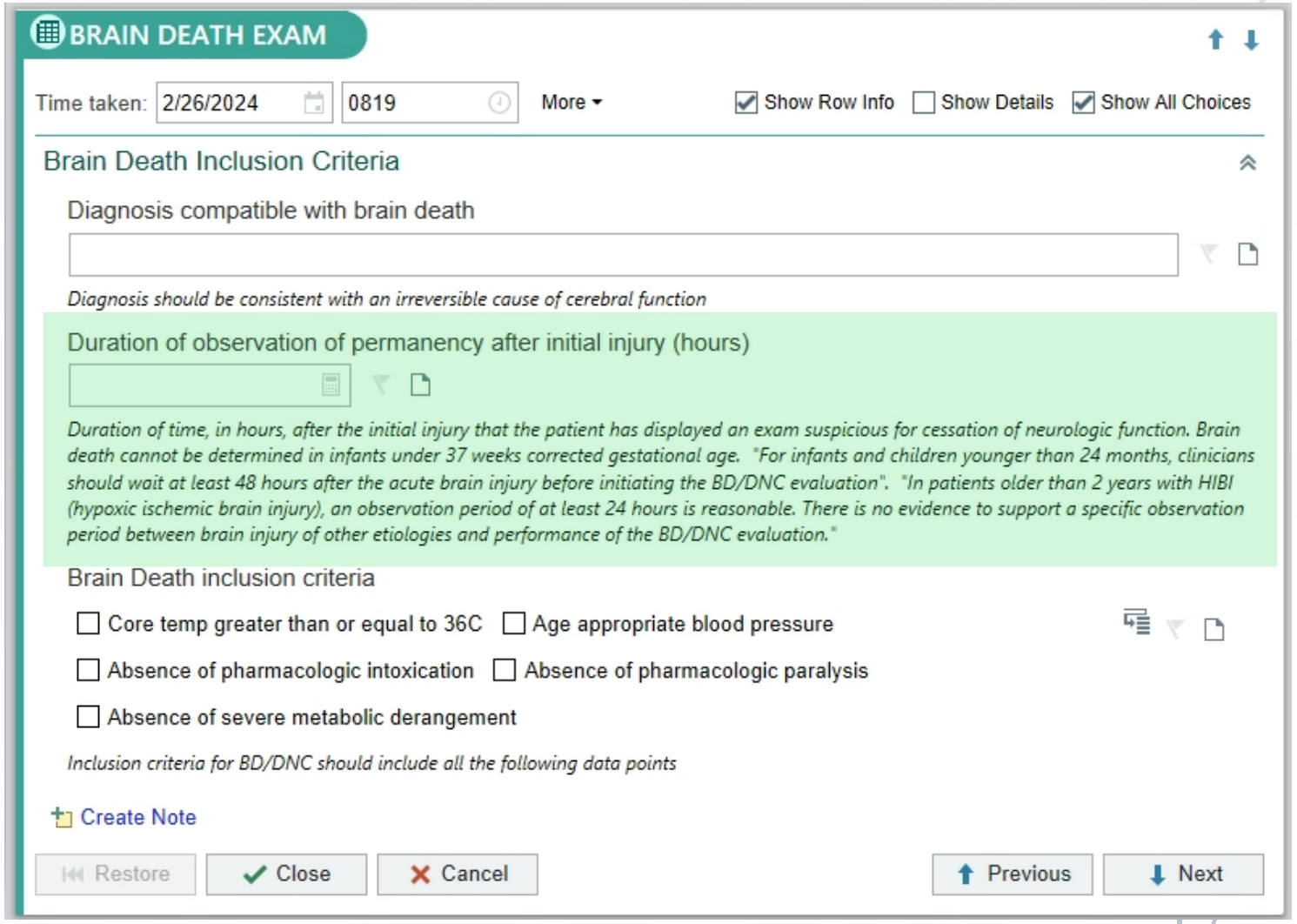
PART 1- GENERAL INFORMATION

- 2-page instructions including **links** to the 2024 AAN guidelines and Vanderbilt policies
- Basic reminders for pre-requisites and inclusion criteria with **reference locations** to the AAN guidelines
- Recommendations for **Ancillary studies**



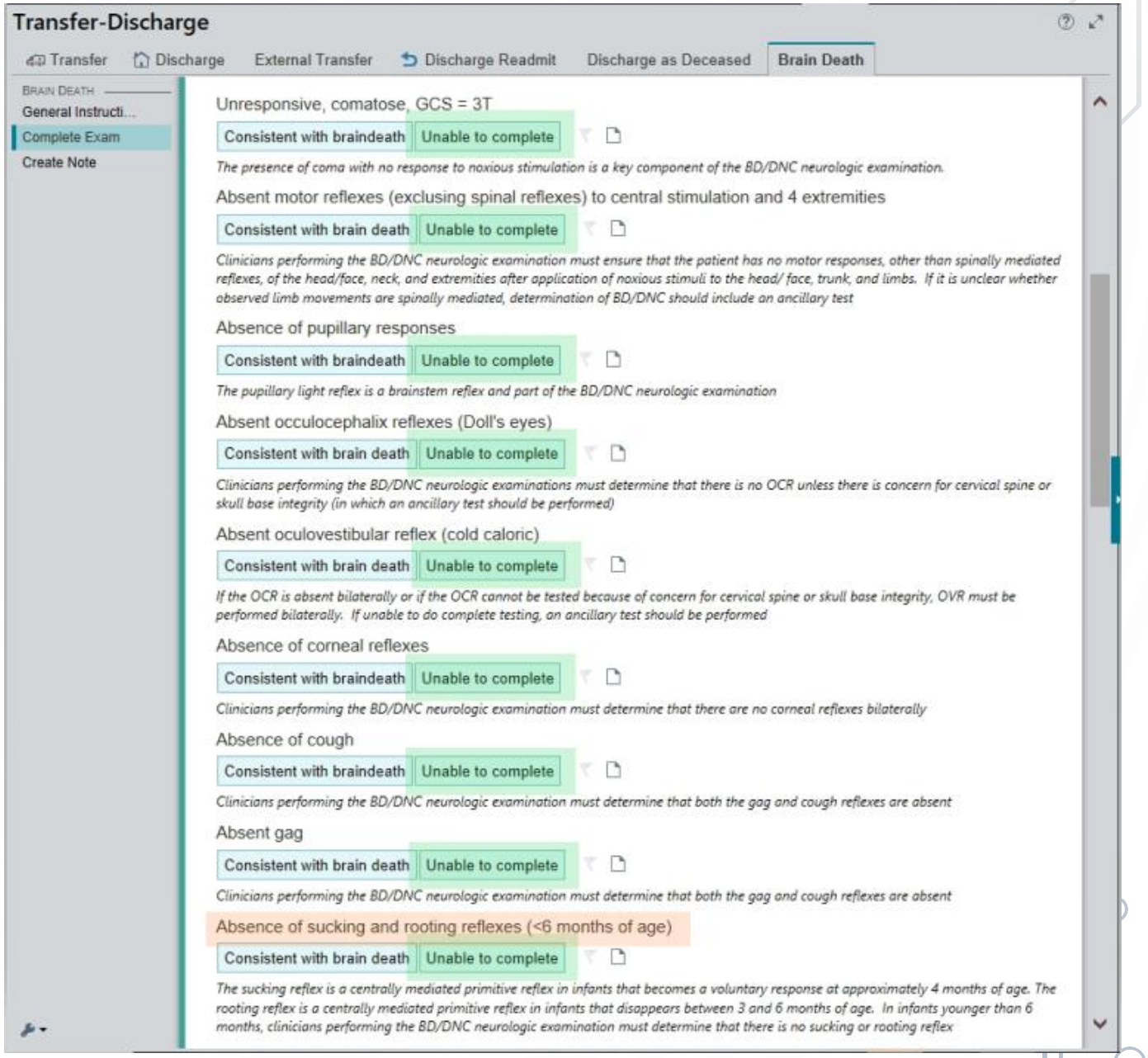
PART 2 – COMPLETE EXAM

- There are two parts to the complete exam: - inclusion data with inclusion criteria and exam components
- Exam components will appear after you select inclusion criteria
- Note: Addition – "**Duration of observation**"



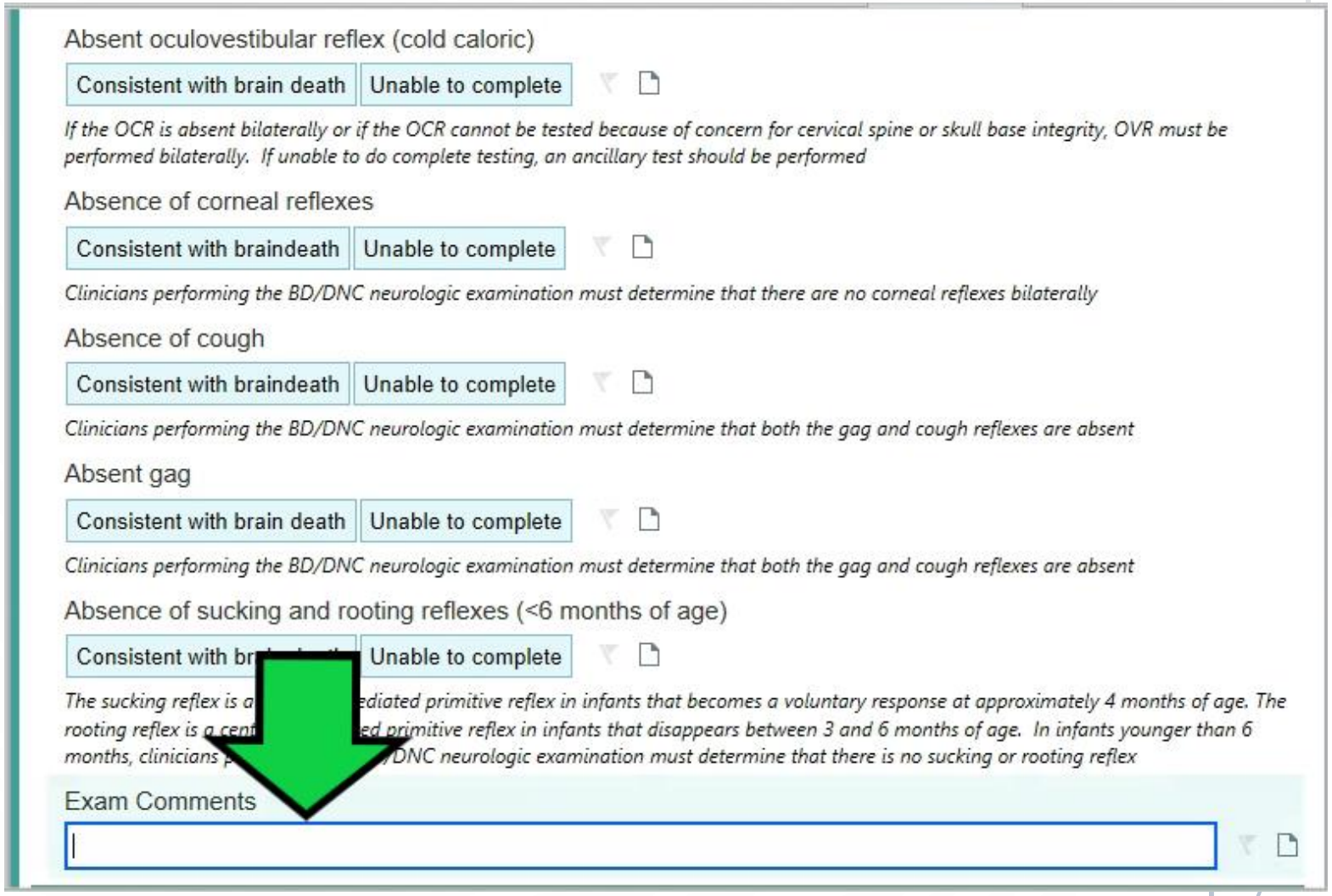
PART 2 – EXAM COMPONENTS

- All brain death exam components are listed with information for each per the AAN consensus statement.
- Note: Terminology change – responses of "Not assessed" are removed and replaced with **"Unable to complete"**.
- Note: Addition of **"Absence of sucking and rooting reflexes (<6months of age)"**. For older patients, the component does not require a response.



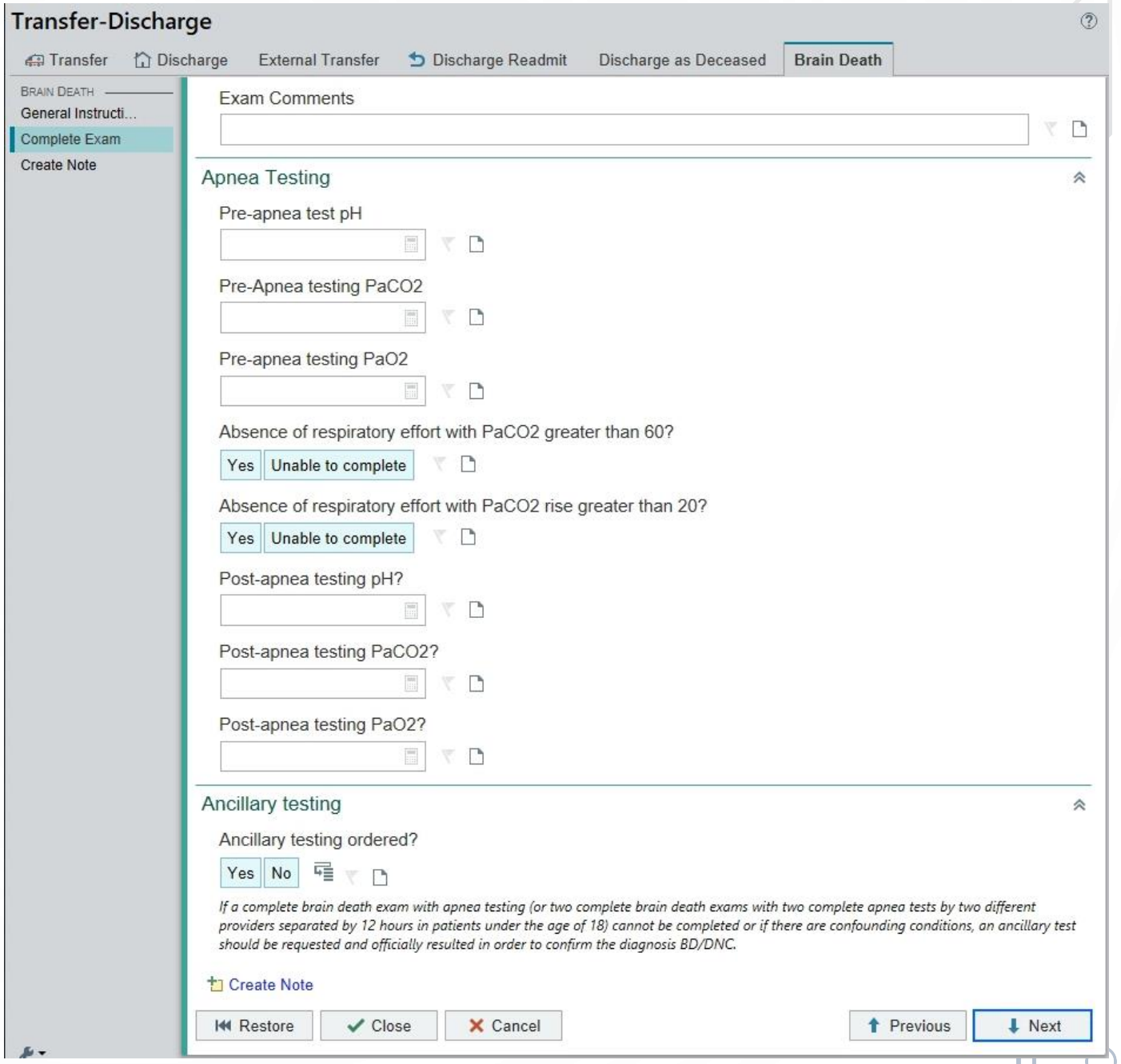
PART 2 – EXAM COMMENTS

- If an exam component is not able to be performed or is indeterminate, free text explanation should go here.



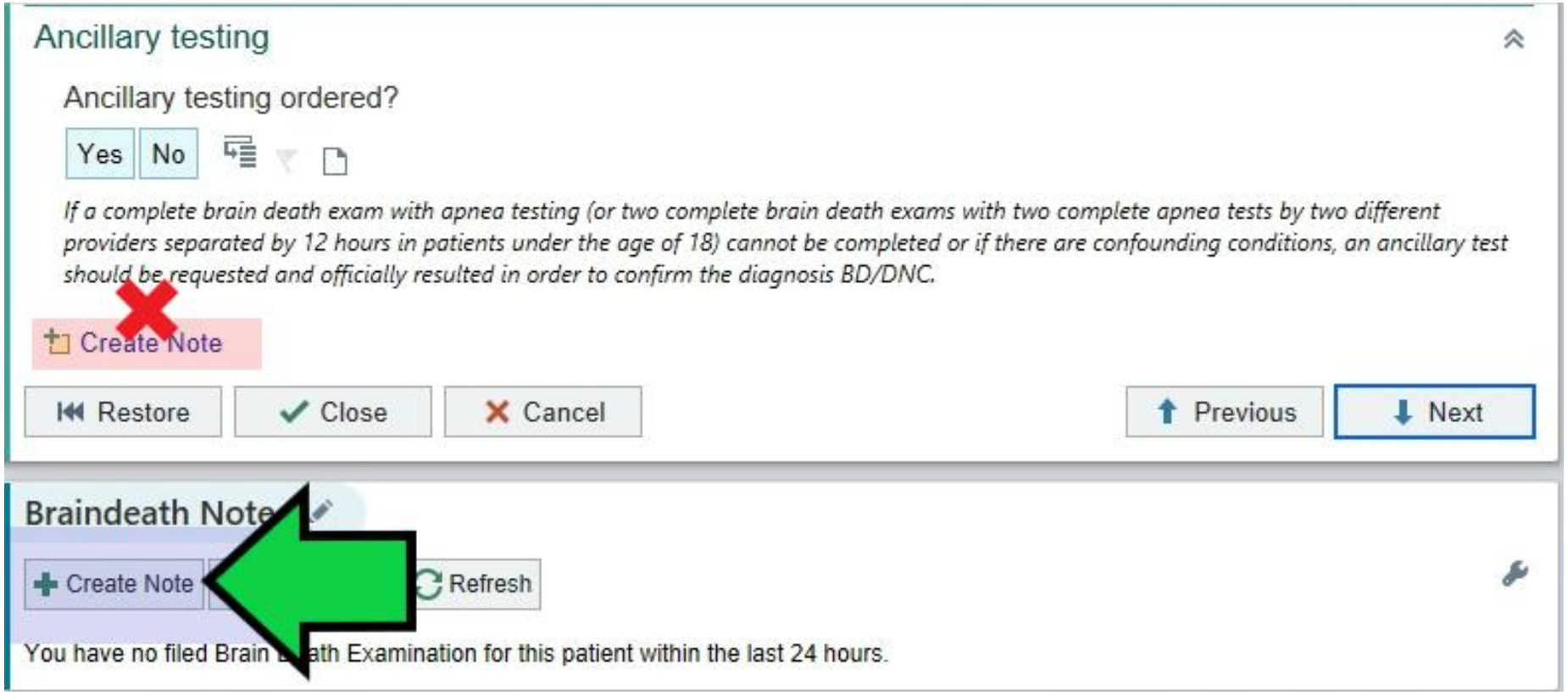
PART 2: APNEA TEST WITH INTERPRETATION AND ANCILLARY TESTING

- An apnea test with an interpretation is required for a complete brain death exam. For patients with two exam requirements (under 18 years of age) apnea tests are required with both examinations for a complete exam
- Indicate if apnea testing is ordered (if any component was indeterminate or marked as "Unable to complete"



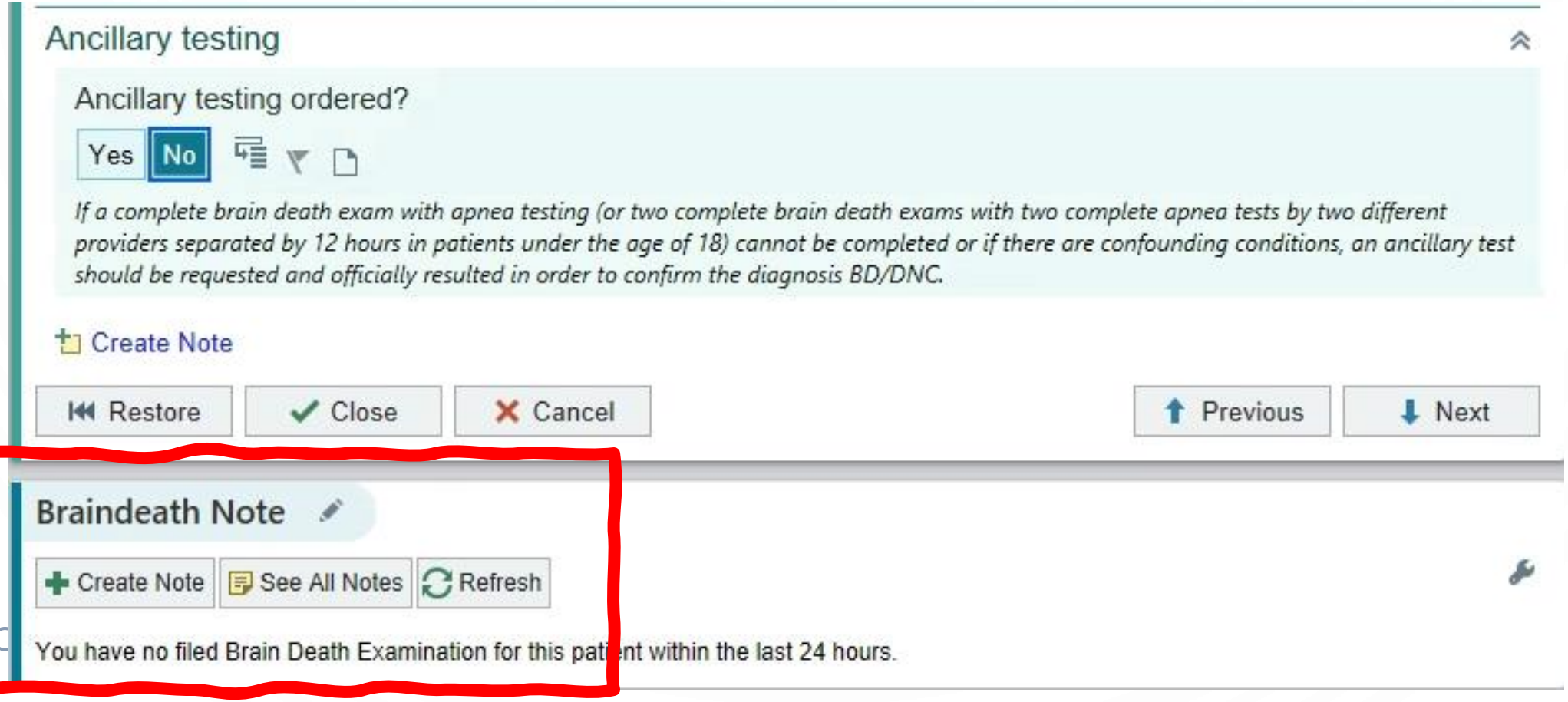
PART 2 : CREATE NOTE – **DO NOT USE**

- Do not use the "Create Note" in the ancillary testing area. This will not give you the correct format, list the results in the approved verbiage, or store the note under the appropriate note type. Instead proceed to the "Braindeath Note" section and select the "+ Create Note"



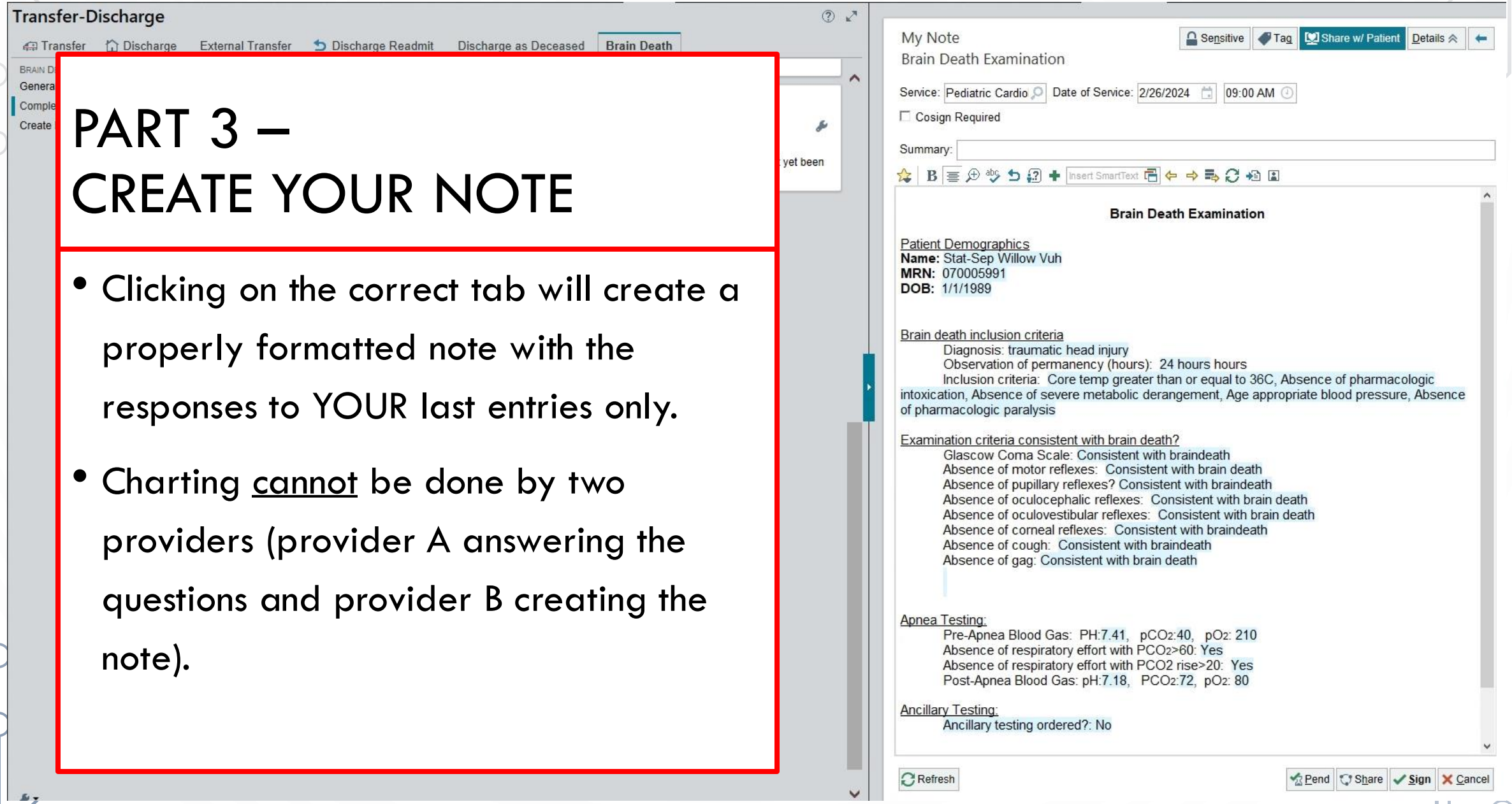
PART 3 – BRAIN DEATH NOTE: CREATE YOUR NOTE

- Using this section will automatically create your note creating the correct universal format and give you the interpretation choices.



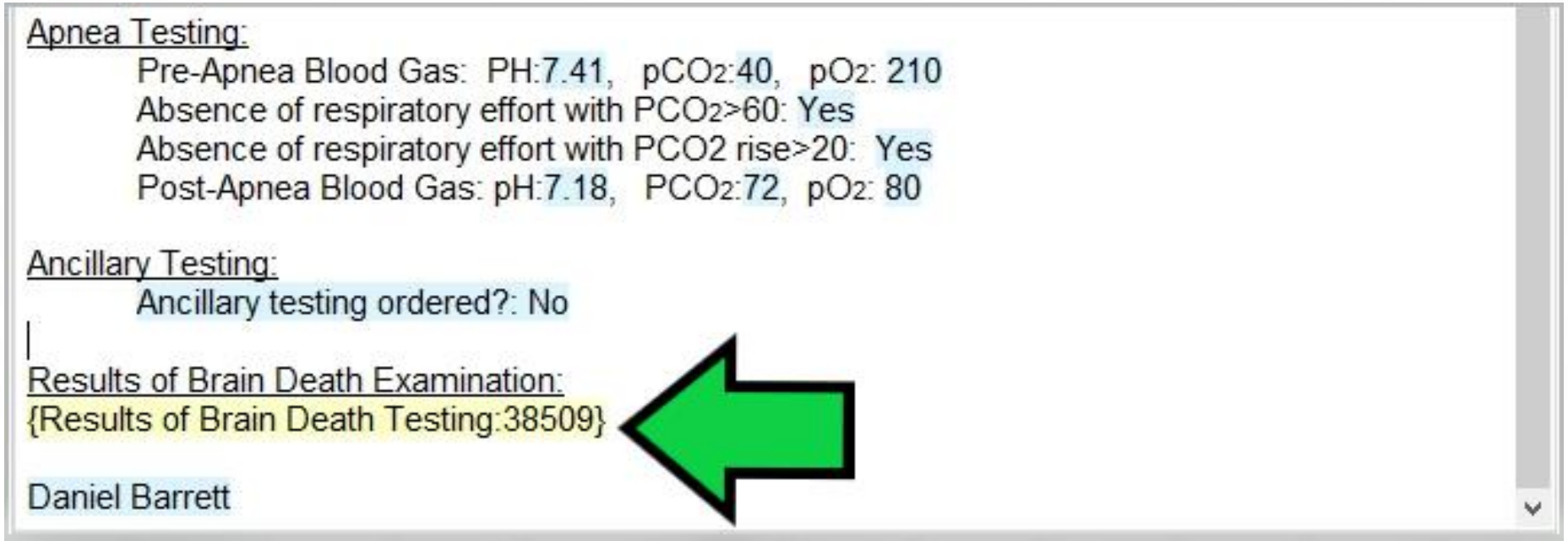
PART 3 – CREATE YOUR NOTE

- Clicking on the correct tab will create a properly formatted note with the responses to YOUR last entries only.
- Charting <u>cannot</u> be done by two providers (provider A answering the questions and provider B creating the note).



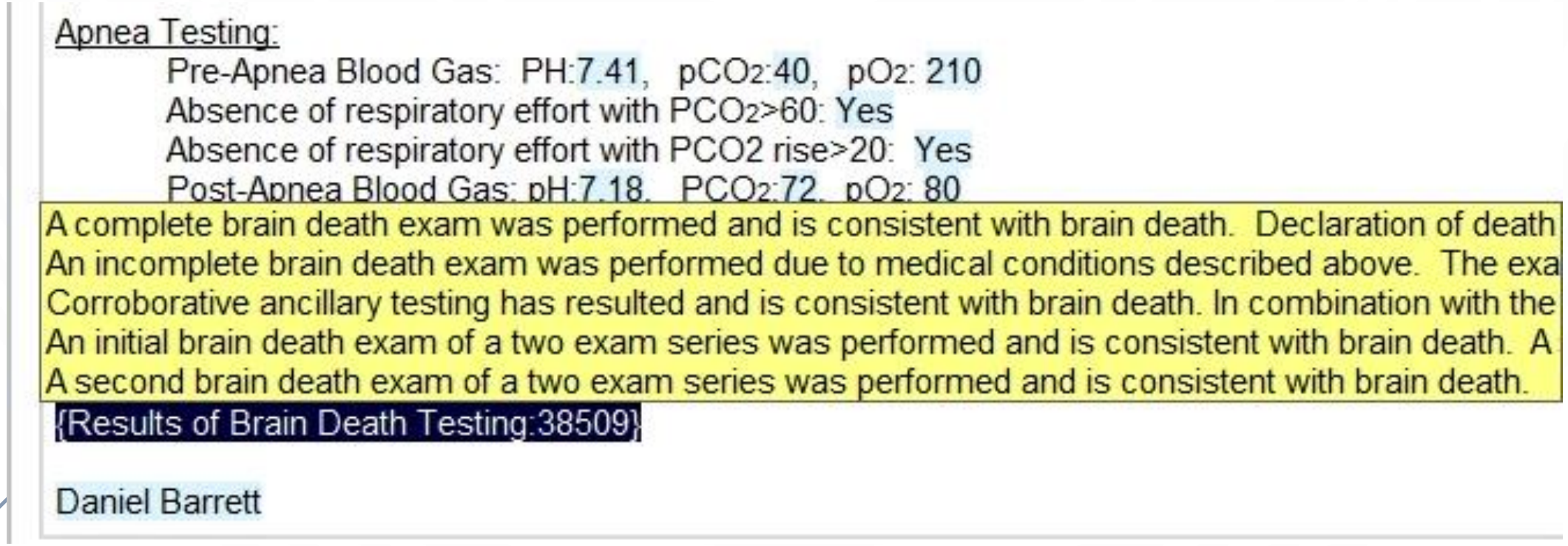
PART 3 – CREATE YOUR NOTE: EVALUATION STATEMENTS

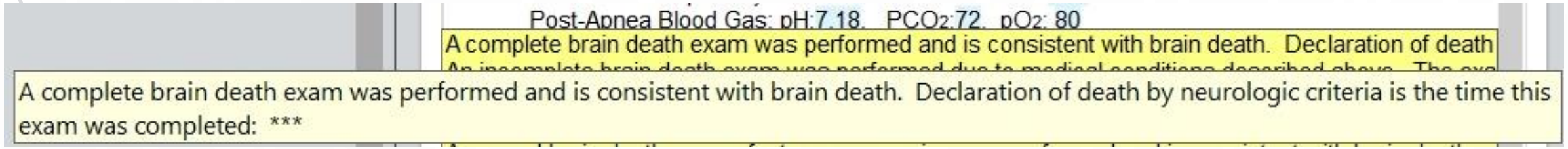
- At the bottom of the note, there are 5 evaluation statements. Press F2 to take you to those statements then hover over to see the complete statement before choosing.
- Generally, patients 18 years and older will use the top 3 statements, and patients under 18 will use the bottom three statements



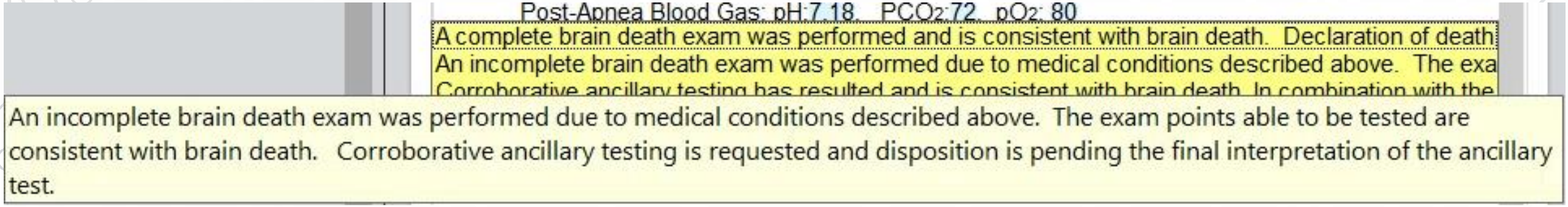
PART 3: INTERPRETATION OF BRAIN DEATH EXAM

- Press F2 to see choices then hover over the choices to view the entire text before selecting.

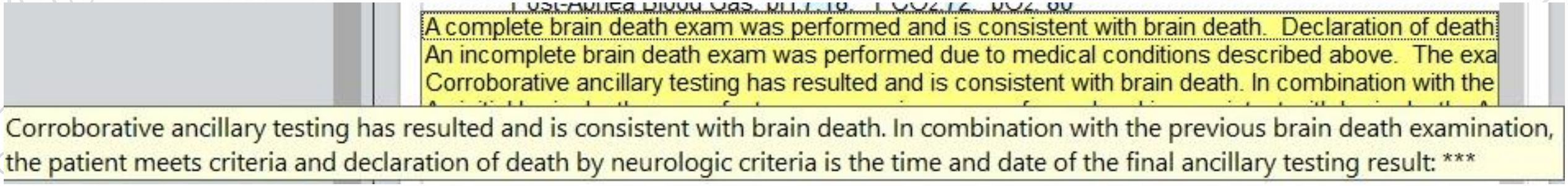




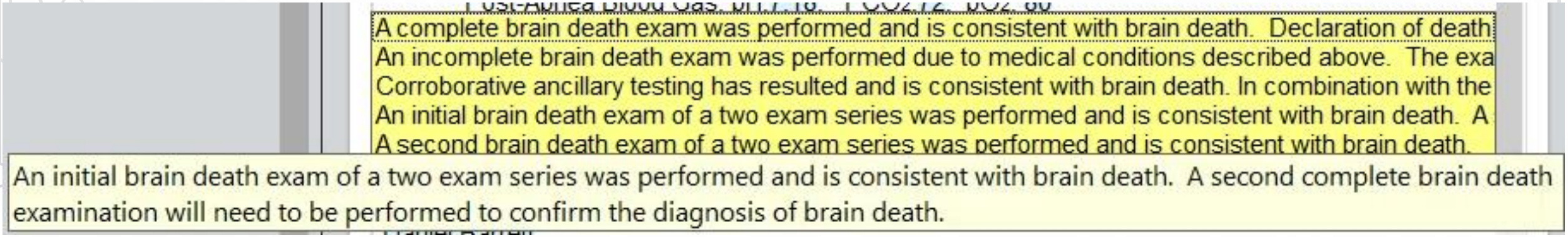
A complete brain death exam was performed and is consistent with brain death. Declaration of death by neurologic criteria is the time this exam was completed : ***



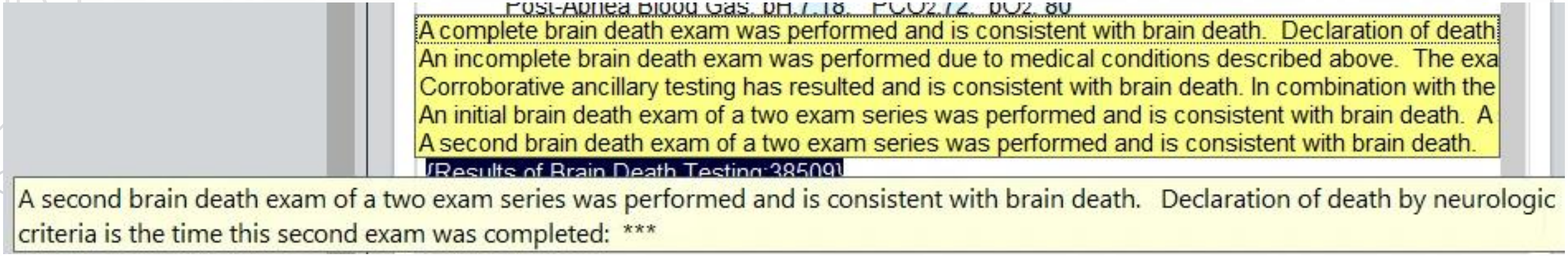
An incomplete brain death exam was performed due to medical conditions described above. The exam points able to be tested are consistent with brain death. Corroborative ancillary testing is requested and disposition is pending the final interpretation of the ancillary test.



Corroborative ancillary testing has resulted and is consistent with brain death. In combination with the previous brain death examination, the patient meets criteria and declaration of death by neurologic criteria is the time and date of the final ancillary testing results: ***.



An initial brain death exam of a two exam series was performed and is consistent with brain death. A second complete brain death examination will need to be performed to confirm the diagnosis of brain death.



A second brain death exam of a two exam series was performed and is consistent with brain death. Declaration of death by neurologic criteria is the time this second exam was completed: ***.

OTHER DOCUMENTATION POINTS

- If a patient has an exam that does not meet brain death criteria (i.e. pupil reactivity, agonal respirations…), this process should NOT be used to document those findings. Please use a progress note, clinical update, acute event or other free text note entry options.
- If Ancillary testing does not corroborate a diagnosis of brain death, this process should NOT be used to document those findings. Please use a progress note, clinical update, acute event or other free text note entry options.

QUESTIONS

- If you have any questions, please feel free to reach out to the content experts. Dr. Michael Wolf, Dr. Dennis Bradley, Dr. Christopher Hughes, Dr. Eddie Qian

- As a reminder, if there are questions regarding pronouncing a patient under the age of 18, the attendings on service in the Pediatric ICU are ALWAYS available (in house call 24/7) to discuss options or assist with the process. 615-456-6828