

## Apnea Test for Neurological Determination of Death (NDD)

### Site Applicability

All VCH & PHC Critical Care Units

- **VCH:** LGH, RH, VGH
- **PHC:** MSJH, SPH

### Practice Level

Basic skills for the following professions (within their respective scope of practice):

- Physician - In order to make the Neurologic Determination of Death, physicians must be licensed for independent practice in the province of British Columbia (i.e. physicians with educational licenses are not able to make the NDD)
- Respiratory Therapist (RT)

### Policy Statement

- **Two physicians must be present throughout the duration of the apnea test to observe for spontaneous respirations. If two physicians can not be present for the entire apnea test, a second apnea test must be performed by a second qualified physician at a separate time.**
- The patient must be monitored on a pulse oximeter throughout the test.
- Patients with elevated temperature or metabolic rate require shorter apnea test time due to higher CO<sub>2</sub> production.

### Need to Know

#### Background

Application of CPAP during apnea testing as a lung protective strategy can increase the number of eligible harvested lungs for transplantation than without CPAP therapy


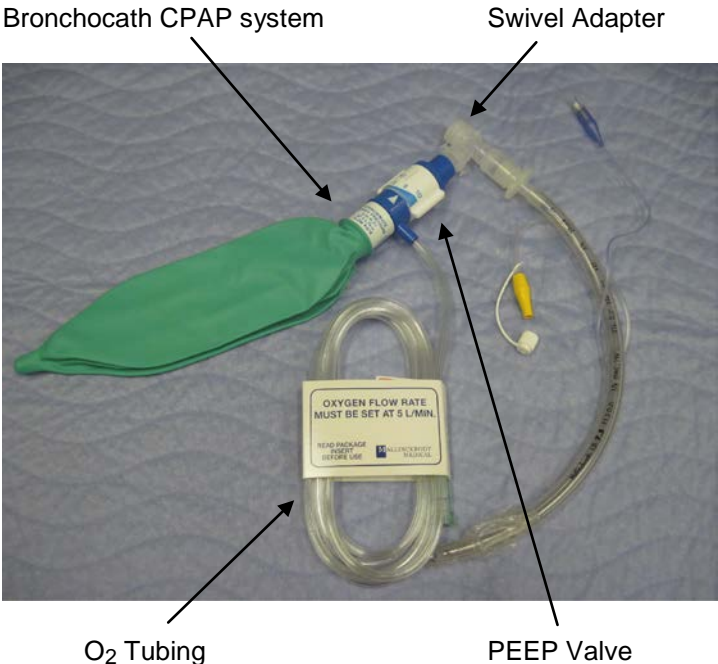
The Neurologic Determination of Death (NDD) is a set of clinical criteria by which a physician confirms a neurologic death in a patient with a severe brain injury. The minimum clinical criteria for NDD are as follows:

1. Established etiology capable of causing neurologic death in the absence of reversible conditions capable of mimicking neurologic death
2. Deep unresponsive coma with bilateral absence of motor responses, excluding spinal reflexes
3. Absent brain stem reflexes as defined by absent gag and cough reflexes and the bilateral absence of
  - a. Corneal responses
  - b. Pupillary responses to light, with pupils at mid-size or greater
  - c. Vestibulo-ocular responses
4. **Absent respiratory effort based on the apnea test**
5. Absent confounding factors including unresuscitated shock, hypothermia (core temperature less than 34°C), severe metabolic disorders capable of causing a potentially reversible coma, peripheral nerve or muscle dysfunction or neuromuscular blockade, clinical significant drug intoxications

## Procedure

### Equipment and Supplies:

**NOTE:** Equipment set up and recommendations may vary from site to site. The basic principle that should be maintained is a closed system, PEEP/CPAP regulated breathing circuit.

PHC Equipment Configuration	VCH Equipment Configuration
<ul style="list-style-type: none"> <li>Manual resuscitation bag with adjustable PEEP valve</li> <li>New in line suction catheter</li> <li>Small bore O<sub>2</sub> tubing</li> </ul> 	<ul style="list-style-type: none"> <li>Bronchocath system (reservoir bag, PEEP valve, swivel adapter and O<sub>2</sub> tubing included)</li> </ul> 

### Procedure:

1. Ensure physician is available and present at the bedside prior to initiation of the test.
2. Obtain PaCO<sub>2</sub> and SaO<sub>2</sub> limits for test from Physician.
3. Ensure PaCO<sub>2</sub> is approximately 40 mm Hg (or patient's baseline level, as per Attending Physician) before starting apnea test. Baseline SpO<sub>2</sub>, HR, BP, and ECG should also be obtained prior to starting apnea test.
4. Pre-oxygenate patient on 100% oxygen before test (recommended time for pre-oxygenation is 10 minutes)
5. Calculate approximate time for PaCO<sub>2</sub> to rise greater than or equal to 60 mm Hg. In a resting patient with normal temperature, PaCO<sub>2</sub> will rise 4 mm Hg the first minute and 2 mm Hg each minute thereafter.
6. Setup CPAP system for use during Apnea Test as per Site Specific Practices
7. Expose the patient's chest and abdomen to allow for unobstructed observation of any spontaneous efforts
8. Observe SpO<sub>2</sub> throughout test
9. If SaO<sub>2</sub> drops below the limit set; obtain arterial blood gases and return patient to ventilator.
10. Obtain ABG after 5 minutes **and** after calculated test time and review with physician. If point-of-care testing is not available – it is recommended that an ABG be taken at the end of the apnea test just prior to returning the patient to the ventilator.

**Note:** This is a **controlled** document for VCH & PHC internal use. Any documents appearing in paper form should always be checked against the electronic version prior to use. The electronic version is always the current version.

- a. The thresholds at the completion of the apnea test should be PaCO<sub>2</sub> above or equal to 60 mm Hg, **and** above or equal to 20 mm Hg rise above the pre-apnea test level, **and** with a pH below or equal to 7.28. These thresholds must be documented by arterial blood gas measurement.<sup>1</sup>
  - b. **NOTE:** Caution must be exercised in considering the validity of the apnea test if in the physician's judgment there is a history suggestive of chronic respiratory insufficiency and responsiveness to only supra-normal levels of carbon dioxide, or if the patient is dependent on hypoxic drive. If the physician cannot be sure of the validity of the apnea test, an ancillary test should be performed.<sup>1</sup>
11. Return patient to previous ventilator settings when test is completed. It is recommended that a "recruitment maneuver" be performed as per site specific practices upon re-establishment of mechanical ventilation (for example, recruitment maneuver using 30cmH<sub>2</sub>O for 30 to 60 sec, or as directed by Attending Physician).

## Site Specific Practices

### PHC, LGH and RH: Equipment Set-up

**Note:** At SPH, prior to starting the Apnea Test contact the Stat Lab so they are prepared to receive serial blood gas samples. Label requisitions as STAT – APNEA TEST.

1. Depress the suction control valve on the inline suction catheter and tape in position (to maintain open communication with catheter).
2. Connect small bore O<sub>2</sub> tubing to O<sub>2</sub> flow meter and set flow to 6 L/min maximum. Connect other end of tubing to suction catheter.
3. Set PEEP valve to 10 cmH<sub>2</sub>O (or as per Attending Physician) and attach to resuscitation bag. Attach flex tube/inline suction catheter to resuscitation bag.
4. Disconnect patient from ventilator and connect to resuscitation bag/flex tube. Advance suction catheter until it sits approximately 2cm above the carina.
5. Compress the resuscitation bag once for 1 breath (for tidal lung recruitment) and allow for passive exhalation to PEEP setting.

### VGH: Equipment Set-up

1. Attach OETT to Bronchocath CPAP system  
**NOTE:** Consider "clamping" the OETT prior to disconnecting the ventilator to limit alveolar derecruitment
2. Set CPAP to 5 or 10 cmH<sub>2</sub>O as per physician order
3. Set oxygen flow rate at 5 L/min  
**NOTE:** The "Bronchocath" system requires 5 L/min be set on the device

## Documentation

Procedure to be documented in the progress notes and/or patient flow sheet.

## Related Documents

PHC: [RTD5213](#) Organ Donor Management, Respiratory

## References

<sup>1</sup>Canadian Council for Donation and Transplantation: Severe Brain Injury to Neurological Determination of Death: A Canadian Forum. April 9-11, 2003, Vancouver, British Columbia.

JAMA: Effect of a Lung Protective Strategy for Organ Donors on Eligibility and Availability of Lungs for Transplantation: A Randomized Controlled Trial. December 15, 2010 – Vol 304, No. 23.262-2627

Paries M., Boccheciampe N., Raux M., Riou B., et al. Benefit of a single recruitment maneuver after an apnea test for the diagnosis of brain death. Critical Care. 16: R116. July 2012.

Previous VGH Apnea Test CPD: Apnea Test RT-SER-45

Consolidation of the following CPDs from Vancouver Coastal Health with current practice updates:

- Vancouver Acute: PCG R-200: Respiratory Services: Apnea Test (May 2006)
- Richmond: Apnea Test (February 2005)

## Developed/Revised by

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*Regional SharePoint 2<sup>nd</sup> Reading – Endorsement:*

Health Authority Profession Specific Advisory Council Chairs (HAPSAC)

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## Final Sign-off & Approved for Posting by

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Professional Practice Standards Committee, PHC

## Date of Approval/Review/Revision

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