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)
    b. In a patient with known baseline CO_2 retention due to pre-existing disease for whom the baseline $Paco_2$ is known, adjust the ventilator to achieve baseline pH/ $Paco_2$
    c. In a patient with known baseline CO_2 retention due to pre-existing disease for whom the baseline $Paco_2$ is not known, adjust the ventilator to achieve estimated baseline pH/ $Paco_2$ (This patient will also require an ancillary test if they do not breathe during the apnea test)

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
3. Ensure respiratory therapist and/or nurse; staff with appropriate expertise in managing the potential cardiopulmonary complications of apnea testing; supplies for multiple ABGs; and vasopressors, inotropes, and/or intravenous fluids are readily available

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.
    b. The catheter diameter should be <70% of the diameter of the endotracheal or tracheostomy tube.
    c. Deliver 100% Fio_2 at a flow rate of 4-6 L/min.
2. Continuous positive airway pressure for all patients using 100% Fio_2 and the same PEEP the patient required prior to the apnea test. The following are acceptable ways to provide CPAP during the apnea test:
    a. Flow inflating bag with functioning PEEP valve
    b. T-piece with functioning PEEP valve
    c. Mechanical ventilator in CPAP mode
        i. Disable default backup apnea ventilation
        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]

Monitoring during the apnea test

1. Monitor the patient's cardiopulmonary status via an invasive arterial catheter, 3-5 lead ECG, and pulse oximeter
    a. If unable to obtain invasive arterial access, use blood pressure cuff with frequent cycling
    b. Visual (bare chest and abdomen) and tactile observation of the patient's chest for movement and abdominal musculature for contraction or evidence of spontaneous breathing. Some chest wall movement, which must be distinguished from respiratory effort, can be observed due to cardiac pulsation or contraction of the intercostal muscles due to acidosis
2. If using a flow inflating bag, monitor for respiratory effort by feeling and watching the bag
3. If using the ventilator in CPAP mode, monitor the flow waveforms for a patient-initiated breath
4. Transcutaneous CO_2 monitoring can be used to follow the rise in partial pressure of CO_2 and guide the timing of ABG sampling

Performance of serial arterial blood gasses

1. $Paco_2$ increases by approximately 2-3 mm Hg per minute during apnea
2. If point of care blood gas testing is available, perform serial ABG's (approximately every 2 minutes) beginning at approximately 8 minutes of apnea, if the patient does not have hemodynamic instability or hypoxemia, until the ABG results are consistent with the criteria below.
3. If point of care blood gas testing is not available, send an ABG after approximately 8 minutes of apnea, but continue apnea testing/repeat the ABG every 2-3 minutes if the patient is hemodynamically stable until the ABG results are consistent with the criteria below. The duration of testing is typically 10-15 minutes but can be carried out for longer if the patient is stable.

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.

3b. In patients who are KNOWN TO HAVE chronic CO_2 retention, and the baseline $Paco_2$ is KNOWN, the $Paco_2$ level is ≥60 mm Hg AND ≥20 mm Hg above the patient's known chronic elevated premorbid baseline level.

3c. In patients who are SUSPECTED TO HAVE chronic CO_2 retention, but the baseline $Paco_2$ is UNKNOWN, the $Paco_2$ level is ≥60 mm Hg AND ≥20 mm Hg above the patient's pre-apnea test level, and an ancillary test is required.

Terminate the apnea test for:

1. Spontaneous respirations or effort
2. Hemodynamic instability or hypoxemia
    a. SBP ≤100 mm Hg or MAP ≤75 mm Hg in adults, or SBP or MAP ≤5th percentile for age in children, despite titration of vasopressors, inotropes, and/or intravenous fluids
    b. Decrease in oxygen saturation below 85%
    c. Cardiac arrhythmia with hemodynamic instability
    d. In infants, bradycardia (<60 BPM), since it can occur before hypotension or hypoxemia
3. Unless the test is being aborted due to spontaneous respirations, obtain an ABG before reconnecting the patient to the ventilator if able. If the arterial pH and $Paco_2$ criteria (as included above) are achieved, the apnea test is consistent with BD/DNC.
4. After resuming mechanical ventilation, transiently increase minute ventilation to achieve normoxia, normocapnia and a normal acid-base status.
5. If the test is aborted but the completion conditions are not met, the apnea test may be repeated for a longer duration if the patient was stable during testing, or an ancillary test may be performed.

