Lung Volume Recruitment with Mechanical Insufflation-Exsufflation (MI-E) in the Adult Population

Quicklinks

Site Applicability

VCH all sites for RT and PT

- **Note:** RN practice limited to VGH Acute Spine Unit and Respiratory wards, and GF Strong Spinal Cord Injury Rehab Unit, George Pearson Center, Purdy Pavilion.
- **Note:** LPN/RPN practice limited to GF Strong Spinal Cord Injury Rehab Unit, George Pearson Center and Purdy Pavilion.

PHC: MSJ and SPH only

Practice Level

Discipline	Basic Skill	Advanced Skill
Physical Therapist (PT)	Entry Level Practice after training in Mechanical Insufflation-Exsufflation (MI-E) machine application (patient assessment, device prescription and treatment), see Performance Checklist (Appendix B) Learning Hub Module for RT and PT	
Respiratory Therapist (RT)	Entry Level Practice after training in MIE machine application (patient assessment, device prescription and treatment), see Performance Checklist (Appendix B) Learning Hub Module for RT and PT	

Registered Nurse (RN) Licensed Practical Nurse (LPN) Registered Psychiatric Nurse (RPN)		**Advanced skill after training:** • Completion of Cough Assist Machine Learning Hub Module for RN and LPN • Review of this decision support tool on airway clearance techniques including Assisted Cough Techniques (BD-00-07-40004) • MIE machine application (patient assessment and treatment with pre-set parameters only), see Performance Checklist (Appendix B)

Requirements

- MI-E should only be performed by trained health care professionals as per their scope of practice.
- RT and PT will determine the need of this therapy for the client, develop an interdisciplinary care plan (Appendix C), and set up the MI-E for each client.
- Nursing practice with MI-E is limited to digital device (e.g., Phillips CoughAssist E70/T70) (Appendix A) in auto mode with pre-set parameters.
- MI-E treatment parameters will be checked against interdisciplinary care plan (Appendix C) prior to each treatment.
- A physician's order is required in the following circumstances to use MI-E:
    - Any patient who requires pressures greater than 40 cmH_2O
    - Patients with impaired consciousness or difficulty communicating
    - Susceptibility to pneumothorax or pneumo-mediastinum
    - Elevated ICP including ventricular drains
    - Surgical interventions to thorax (e.g. sternotomy, thoracotomy, chest tubes)

Need to Know

MI-E is used when a patient is unable to generate sufficient inspiratory force and/or expiratory force to produce an effective cough to clear secretions. This may be due to neurological impairment, fatigue and/or weakness in association with tenacious or excessive secretions.

MI-E is an Aerosol Generating Medical Procedure, perform a Point of Care Risk Assessment before performing this procedure and select the appropriate personal protective equipment (PPE) and environmental controls.

Initiating treatment:

- A digital machine in auto mode with pre-set treatment parameters will be designated to each client receiving this therapy from RNs.
- MI-E manual mode settings may be used by RT or PT only.
- Competency in Assisted Cough Techniques (BD-00-07-40004) is a prerequisite for applying this treatment. Some definitions that are necessary for understanding this policy are available in that document.

Descriptions:

Please see Assisted Cough Techniques BD-00-07-40004 for important definitions not listed here.

- **Mechanical Insufflation-Exsufflation (MI-E):** the use of a mechanical device which gradually applies a positive pressure to the airway, then rapidly shifts to negative pressure. The rapid shift in pressure produces a high expiratory flow, simulating a natural cough. Also known as a CoughAssist machine (Proprietary term by Phillips).
- **Maximal Insufflation/inspiratory Capacity:** The maximum volume of air within the patient's lungs introduced by MIE or other kinds of lung volume recruitment (forced vital capacity after lung volume recruitment).
- **Peak cough flow:** Maximum air flow generated during a cough, measured with peak cough flow meter in L/min.

Indications for use of MI-E:

- **MI-E** is used with patients/residents/clients who are unable to effectively clear secretions due to neurological impairment and/or muscle weakness. An assisted cough (BD-00-07-40004) is often used in conjunction with MI-E.
- It has been found to be effective to maintain chest wall flexibility in the spinal cord injured population
- **Typical client populations**: Clients with neurological impairment to inspiratory and expiratory muscles (e.g. Spinal cord injury (above L2), Guillian Barre Syndrome); clients with restrictive pulmonary disorders following extubation
    - Peak cough flow of greater than 300 L/min indicates someone who is not appropriate for this technique.

Risks associated with MI-E:

- **MI-E has inherent risks** associated with the maneuver. Complications of use of the insufflator-exsufflator, which are rare, include barotrauma, nausea, abdominal distention, bradycardia and tachycardia. A rapid decrease of intrathoracic pressure during exsufflation could predispose to gastroesophageal reflux and aspiration, though clinical experience shows this is rare.

Contraindications

- Any patient with a history of bullous emphysema
- Patients with unresolved barotrauma or pneumothorax

Precautions - A physician's order is required in the following circumstances to use MI-E

- Patients with impaired consciousness or difficulty communicating
- Susceptibility to pneumothorax or pneumo-mediastinum/ high risk of lung injury
- Elevated ICP including ventricular drains
- Surgical interventions to thorax (e.g. sternotomy, thoracotomy, chest tubes)
- Requiring pressures greater than 40 cmH2O is not a precaution but **requires Physician Order**
- Unstable spine
    - Follow spinal precautions
    - Ensure you can maintain neutral alignment before proceeding
    - May require someone to hold head during procedure
- Unstable artificial airway
    - Ensure stability before proceeding

Relative Precautions - No physician's order is required but proceed with caution and monitor closely

- Patients with a history or risk of gastroesophageal reflux or are experiencing conditions that may pre-dispose them to reflux (e.g. a bowel obstruction or recent nausea/vomiting) should be carefully assessed by the interdisciplinary team.
- Patients with a history of hemodynamic instability, bradycardia or tachycardia during respiratory care (e.g. suctioning or assisted cough) should be monitored closely during treatment. Patients with spinal cord injury are at higher risk of these problems due to neurogenic shock.
- Ventilated patient: MI-E may be performed on ventilated clients, whether invasive (through an artificial airway, either oral endotracheal tube or tracheostomy tube) or noninvasive (BiPAP, etc.).
    - Consider the following in the clinical decision of how to proceed for a given patient (consult with team members and/or an educator if unsure).

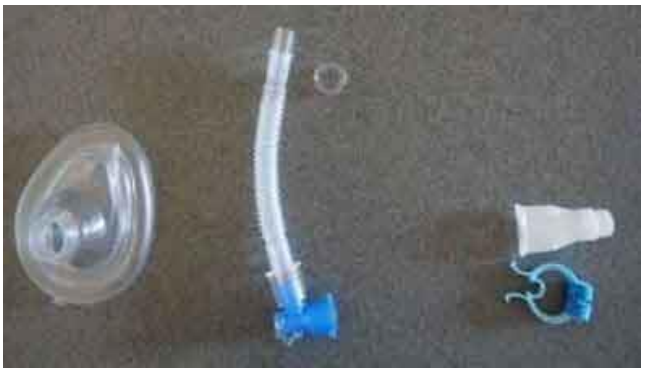
Ventilator Disconnection	• Disconnection from ventilator needed to use the MI-E device • A ventilated patient (invasive or non-invasive) is likely to have impaired ability to breathe on their own • Consider the need for increased rest periods on the ventilator or during manual ventilation (bagging) during the assisted cough procedure

Ventilator Monitoring	• Ensure ventilator monitoring post-procedure • Verifying alarms are active and appropriately set (alarm silence feature should be reset after assisted cough) • Pressures/volumes are compared to previous levels • Artificial airway is in place and secure, tubing connections are secure, and all parameters have been reset to previous levels

Equipment and Supplies

- Personal protective equipment and excellent hand hygiene as per Infection control guidelines at VCH and PHC
- Supplemental equipment as indicated: oxygen, pulse oximeter, Resuscitation Bag / Bag-Valve Mask (BVM) e.g. Ambu-bag, suctioning equipment
- Where Mechanical Insufflation-Exsufflation is to be performed by RNs, digital models will be used in **automatic mode only**. At the time of writing, the Phillips CoughAssist E70 is the digital model in use at VCH facilities. See Appendix A for pictures and references.
- For the patient interface, you will need: a bacterial/viral filter and 1.8 – 2.7 meter (6 to 9 feet) 22mm flexible tubing with the appropriate interface such as a facemask, adapter and mouthpiece with nose clips, or tracheostomy tube adapter. These are single patient use.
- You may also choose to have a second filter and a short (6 inch) length of flexible tubing between the 6 foot length of flexible tubing and the patient interface. This is advantageous because it is easier to clean between treatments.

Bacterial/viral filter and 1.8 – 2.7 meter (6 to 9 feet) 22mm wide flexible tubing



Facemask or adapter and tracheostomy tube or mouthpiece adapter

E70 with two filter setup: Bacterial/viral filter in machine port, and 1.8 – 2.7 meter (6 to 9 feet) 22mm wide flexible tubing, second filter, adaptor and 6" long flexible tube to catch secretions. The appropriate patient interface would be attached to this.

Cleaning and Maintenance of Equipment

Cleaning the Device

The device's exterior surface should be cleaned before and after each patient use and more often if needed.

1. Unplug the device and clean the front panel and exterior of the enclosure as needed using one of the following cleaning agents:
   a. A clean cloth dampened with water and a mild detergent
   b. 70% Isopropyl alcohol
   c. DisCide Towelettes
   d. 10% Chlorine bleach solution
2. Inspect the device and tubing for damage after cleaning. Replace any damaged parts.
3. Allow the device to dry completely before plugging in the power cord.

Cleaning and Replacing the Air Filter

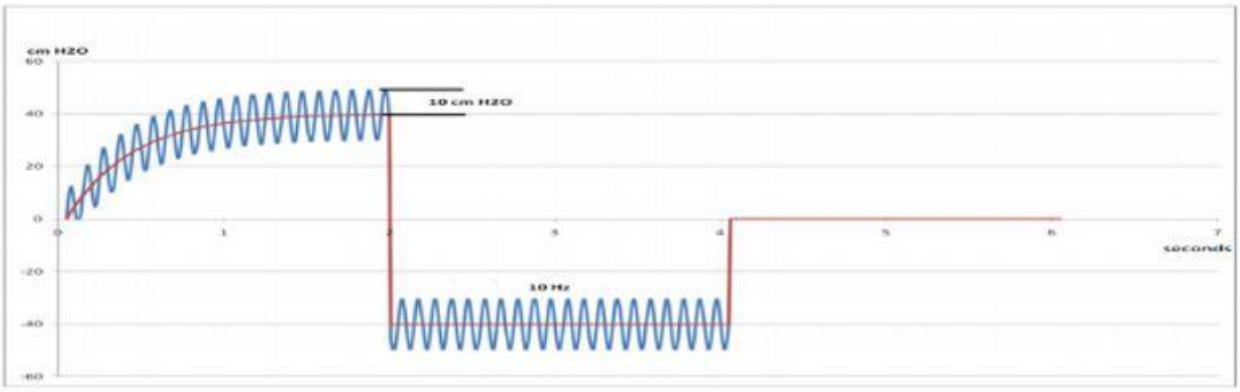
Under normal usage, you should clean the air filter at least once every two weeks and replace it with a new one every six months.

1. If the device is operating, stop the airflow. Disconnect the device from the power source.
2. Remove the filter from the enclosure.
3. Examine the filter for cleanliness and integrity.
4. Wash the filter in warm water with a mild detergent. Rinse thoroughly to remove all detergent residue.
5. Allow the filter to air dry completely before reinstalling it. If the filter is torn or damaged, replace it. Only Philips Respironics-supplied filters should be used as replacement filters.
6. Reinstall the filter.

Practice Guideline

Setting pressures on the MI-E machine (RT and PT only): Bronchial Hygiene

1. For a patient/resident/client using this device for the first time, it is advisable to begin with lower pressures, such as 10 to 15 cmH_2O positive and negative pressure, and low inhale flow. It will familiarize the patient with the feel of mechanical insufflation-exsufflation.
2. As the patient/resident/client becomes more comfortable with the therapy, progressively increase the inspiratory and expiratory pressures by 5 to 10 cmH_2O each sequence of 3 to 5 breaths.
3. The usual therapeutic pressures are + 40 cmH_20 and - 40 cmH_20
4. The minimal effective pressures are + 30 cmH_20 and - 30 cmH_20
   a. Optimal inhale pressure may vary from patient to patient depending on lung and chest wall compliance.
   b. Pressures higher than 40 cmH_2O (on inhale or exhale), **REQUIRE** a doctor's order but have been used safely in the community.
   c. For patient comfort and treatment effectiveness, exhale pressure should be equal to or greater than inhale pressure.
5. Evaluating appropriate pressure settings:
   a. Make sure the patient/resident/client is comfortable.
   b. Look at the display as described below in Appendix A
      i. Peak cough flow should be greater than 270 L/min.
      ii. "Tidal volume" (the amount of air the machine is delivering to the lungs during the insufflation phase) should be larger than their vital capacity and close to their maximal insufflation capacity. Maximal insufflation capacity ranges by patient age, body type and disease type. Reference values for different diseases are available and vary from 1250 mL to more than 2500 mL in neuromuscular disease, and more than 4L in healthy patients.
      iii. If you notice that the peak cough flow/tidal volume is lower than expected check that the patient has a good seal on mouthpiece or mask. If using a tracheostomy interface with cuff down assess air leak at mouth and nose.
   c. If the patient/resident/client is not clearing secretions effectively, try higher pressures keeping in mind the limits above.
6. *Oscillations*
   a. When oscillation is enabled, the delivered pressure, based on the amplitude setting, oscillates between the set amplitude during both inspiration and expiration. In the example below, with a set pressure of +40 cmH_2O and -40 cmH_20, and amplitude set at 10 cmH_20, the oscillations will go between 30 to 50 cmH_20 on inspiration and -30 and -50 cmH_20 on expiration. By the time the air pressure fluctuations reach the delicate alveoli, there is not much pressure difference above baseline and no MD order is needed in this case.
   b. Amplitude can be set from 1 to 10 cmH_20 in increments of 1 cmH_2O keeping in mind amplitude will provide pressure on top of your set pressure for inspirations and expiration.
   c. Frequency indicates how fast the oscillations are delivered and can be set from 1-20Hz in increments of 1Hz.
   d. Lower amplitudes with higher Hz tend to be more comfortable for patients/clients/residents, however, settings are based on patient preference.



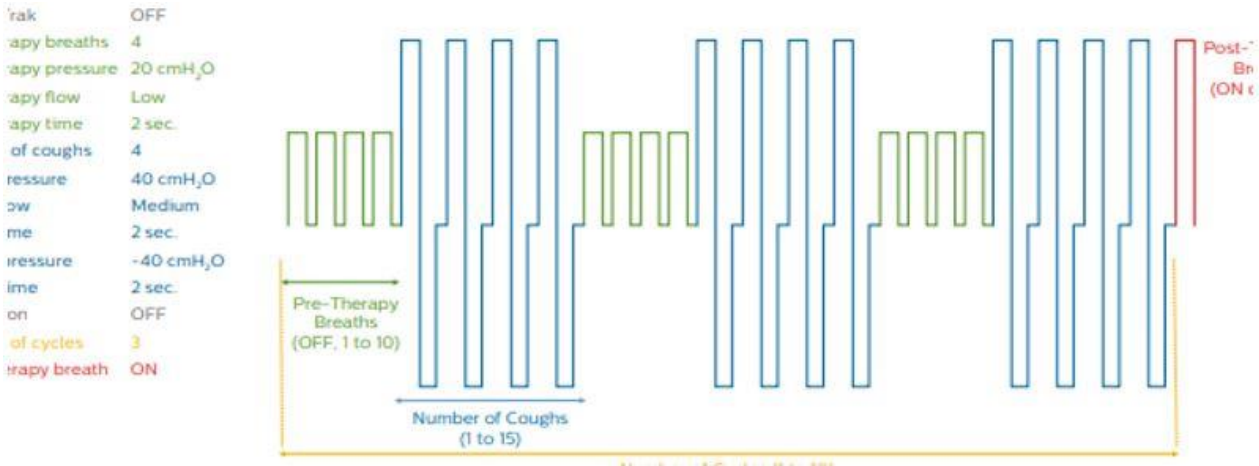
7. *Advanced Automatic Mode: Pre & Post Therapy Breaths*
    a. Pre-Therapy Breaths can be programmed to deliver breaths before the cough treatment. One or more insufflation breaths can be set in order to promote breath stacking, or to provide repeated cycles of thoracic expansion.

    Suggested settings:
        i. Cough trak turned off and a pre-therapy pause time of 2 seconds.
        ii. Pre-therapy breaths set between 3-10 with a time of 2 to 4 seconds.
        iii. Pre-therapy pressure set at 20 to 40 cmH_20, and flow set to low-high.
        iv. The above settings may be adjusted as per patient preference and comfort level.

    b. Cough therapy settings allow you to set the number of coughs (insufflation, exsufflation, and pause) delivered during a cycle.
        i. The number of coughs should be set between 1 to 4 or as per patient preference and comfort level. (Note: In Auto Mode – cough will continue until it is put in Standby)
        ii. Inhale flow set to patient comfort (low/medium/high) .
        iii. Please see practice guideline above to set the inspiratory and expiratory pressure. The usual therapeutic pressures are + 40 cmH_20 and - 40 cmH_20. Set an inhale and exhale time of 2 to 3 seconds.

- Number of cycles can be set between 1 and 10. Setting 1 cycle will allow you to facilitate a 30 second rest period and suctioning between cycles as the machine will go in to Standby mode. At which point therapist should reassess further cycle is required.

    c. The Post-Therapy Breath allows the clinician to end the Cough-Assist therapy on a positive pressure breath by delivering one additional insufflation at the very end of the treatment. However it is recommended to be OFF as it can push secretions back down the airway. Instead, it is recommended to follow a bronchial hygene session with a lung recruitment setting on a different preset.



The above image is an example of how the Advanced Auto mode delivers therapy based on settings of Pre-Therapy breaths, Cough Therapy, and a Post Therapy breath.

Setting pressures on the MI-E machine (RT and PT only): Lung Volume Recruitment

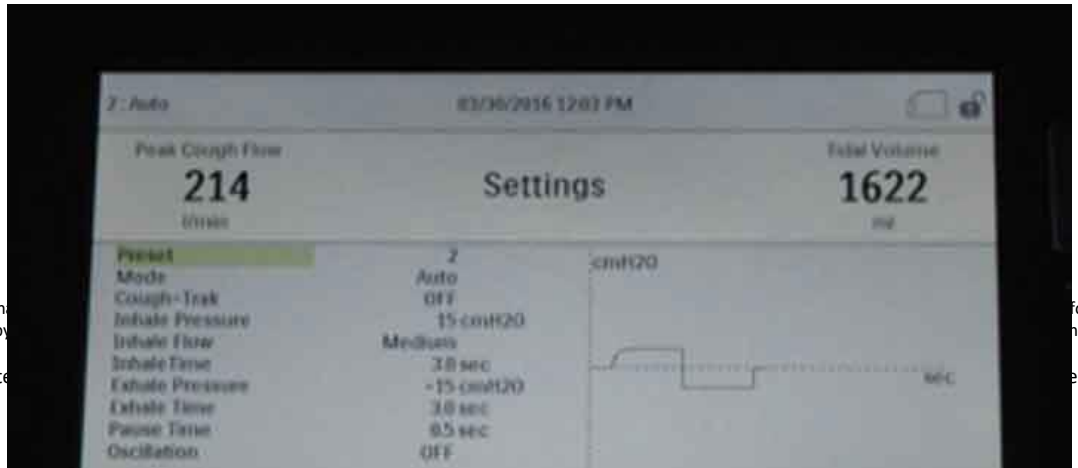
The MI-E can also be set to provide recruitment breaths in order to facilitate and maintain chest wall flexibility, functional residual capacity and to prevent atelectasis. This technique can be used post-bronchial hygiene to re-expand the lungs, or by itself.

1. For using MI-E for lung volume recruitment, recommended way to recruit is with one long slow breath.
2. The technique can be performed in Auto mode or in Manual mode before and after MI-E session instead of Advanced Auto mode.
3. Identify maximum comfortably tolerated inhale pressure (>30 cmH20) may obtain order for pressure >40 cmH20
4. Inspiratory time can be set from 2-5 seconds, slowly extending inhale time to maximum and comfortable time (no greater than 5 seconds).
5. Exsufflation pressure is set to zero.
6. Expiratory time same as inspiratory time if >1 cycle is desired. Ensure to have minimum of 5 seconds if only 1 cycle is used.

Setting options on the MI-E machine (RT and PT only)

There are several options available to set on the MIE machine:

- **Mode:** the machine can be set to automatically trigger or be used with manual control. Only RT and PT may use manual control.



- **Coughtrak:** In automatic mode, this allows the machine to start a cycle of insufflation-exsufflation when triggered by the patient's inhale (negative pressure at the mouthpiece). When this is off, the machine cycles based on the settings below regardless of what the patient is doing.
- **Inhale flow:** The speed the air fills the lungs in combination with inhalation time and pressure (rise time) . Adjust inhale flow as per patient/resident/client comfort. A low inhale flow may be preferable to someone with flaccid airways.
- **Inhale time:** The amount of time the machine will spend in insufflation. This should range from 2 to 3 seconds. Generally, if the inhale flow is high, two (2) seconds is appropriate, while three (3) seconds is appropriate for medium and low flow.
- **Exhale time:** The amount of time in exsufflation. Generally this should be equal to inhale time but can be adjusted for patient comfort. Shorter exhale time will increase flow, which can increase cough effectiveness.
- **Pause time:** The time the machine waits between exhale and to next cycle of inhale in automatic mode (does not work in self-triggered/coughtrak mode). It is recommended to set Pause time to zero because the patient/resident/client can passively breathe through the circuit during pause time, which can cause dyssynchrony with the MI-E when the next insufflation occurs.
- **Oscillation:** Causes the air pressure to rapidly increase and decrease as the air goes in and/or out of the lungs, giving a vibratory effect to the breath
- **Advanced Automatic mode:** Allows for pre and post cough therapy insufflation by offering successive insufflations prior to cough therapy and by delivering one additional insufflation at the very end of treatment.
- NB: There is no evidence for or against options such as oscillation or coughtrak; whether you use these will depend on patient/resident/client and care-giver preference.

General assessment (All care providers):

Please see Assisted Cough Techniques (BD-00-07-40004) for guidelines in assessment.

Planning (all care providers):

1. You may use MI-E alone or in conjunction with other secretion clearance techniques. Among the factors to consider are: efficiency and effectiveness of treatment, measured peak cough flow, need for suctioning and patient factors (i.e. comfort and fatigue).
2. Determine number of caregivers required for an effective treatment as determined by client needs (i.e. adjunctive assisted cough – 1 person vs. 2 person technique, suctioning, etc.).
   a. Only one caregiver in a two person technique needs to be trained in the use of MI-E.
3. Get a paper towel or blue pad to hold any secretions. Set up suction equipment if required.

Procedure (all care providers):

- The RT and PT may use the manual mode of the digital devices.
- **RN must have the digital machine in auto mode, which has been set up by RT or PT and is outlined in the orders and/or interdisciplinary care plan (Appendix C).**

1. **Wash hands and don personal protective equipment.**
2. **Preoxygenation:** Assess oxygen requirements and pre-oxygenate as necessary (e.g. if the patient has a history of desaturating during this technique; if the patient has a spinal cord lesion above T5 and has a history of vasovagal responses). Ensure oximetry is adequately monitored throughout procedure if the client has the potential to decompensate. The MI-E device is not able to deliver supplemental oxygen during treatment. If the patient is prone to desaturations during treatment or when disconnected from oxygen source, pre-oxygenate patient before initiation of treatment.
3. **Explain the procedure** to the client and obtain consent.
4. **Position client**. This procedure is most effective when a client is supine or side lying. It can be modified to be performed in a sitting position but may not be as effective because the secretions must be moved upward against gravity. Make sure the head is supported. Consider caregiver body mechanics if using an assisted cough at the same time. Review Assisted Cough Techniques (BD-00-07-40004) for assisted cough techniques and considerations.
5. **Plug in and turn on the machine**.
6. **Position the unit** within easy reach of the patient and the operator of the unit. CAUTION: Position the device so that the air intake ports on the side and rear of the unit are not blocked.
7. **Assemble** the patient circuit (filter, breathing hose and patient interface) as follows:
   - Attach the bacterial/viral filter to the patient port of the machine (on the right side of the machine)
   - Attach the 6 to 9 foot 22mm ID smooth bore (flexible tubing) breathing hose to the bacterial/viral filter.
   - [optional] Attach a second bacterial/viral filter and a 6 inch piece of flexible tubing to catch secretions.

- Attach the appropriate patient interface to the breathing hose. Patient interface options include a facemask and adapter, mouthpiece and nose clips, or tracheostomy tube adapter.
  - Some patients are unable to maintain a seal around the mouthpiece and need to use the facemask (as evidenced by air leakage); other patients find the facemask claustrophobic.
  - Some facemasks now have the option of letting some air out of the balloon which makes the cushion that actually touches the face more pliable; this may allow you to use it even if the patient has a nasogastric tube.

8. **Verify pressure settings**: (For Respironics CA3000 CoughAssist Device only – Analog machine)
   - Occlude end of tubing
   - Turn to therapy mode
   - In manual mode (RT and PT only): Slide manual control lever from (+) to (-) to check set pressures.
   - In auto mode (all care providers): watch the screen to ensure that the horizontal bar measuring pressures reaches the positive and negative pressures on the screen through two cycles (see video or manufacturer's guideline for clarification).
     - If CoughTrak (patient triggered) mode is on, you will need to occlude the tube, quickly remove and replace your hand to trigger the machine.
   - **Verify pressure settings before each treatment by consulting the care plan**. If the pressure settings are above 40 cmH_2O ensure that a physician's order is on the chart.

9. **Perform the technique**:
   - Remove the patient from the ventilator (if applicable)
   - Give the patient the mouthpiece/facemask or install the adapter on the tracheostomy tube
   - Watch the machine - during the inspiratory phase, say "in-in-in" and on the expiratory/cough phase say "out-out-out".
     - Manual mode (RT and PT only): Defaults to 2 to 3 seconds in and 2 to 3 seconds out; otherwise the time should be already set on the machine
     - Analog machine (RT and PT only): Coordinate inspiratory phase with patient's breathing pattern. Slide the manual control lever to (+inhale) and hold for 2 to 3 seconds.
     - Do not remove the mask/mouthpiece/adaptor during the exsufflation phase even if the patient is coughing.
     - If the patient is coughing but it is not synchronized with the exsufflation phase, disconnect the MI-E machine until they are able to finish coughing.
     - If using a concurrent assisted cough, pressure should be applied as the machine switches from inhale to exhale mode.
     - Watch to make sure you are maintaining a good seal around the mouthpiece or face mask. Support the head or change the patient interface as needed.
     - If secretions are expelled into the tubing, remove the machine and use the paper towel/blue pad to catch/clear the secretions or change for new clean supplies if needed.

- Perform three to five (3-5) sets of three to five (3-5) breaths with rests of at least 30 seconds between sets.
- Patients requiring supplemental oxygen can be oxygenated with the resuscitation bag between MI-E treatments.
- Suctioning may be necessary in some patients and you must be trained in this technique if suction is required. Please see CPD for open tracheostomy suctioning (D-00-07-30105) as well as respiratory therapy documents for closed tracheal suctioning (D-00-12-30239) and Pharyngeal airways (D-00-12-30237). May not be a need to go deeper than the tip of the trach tube since the MIE unit brings up the secretions.

10. Once bronchial hygiene is completed, change to Lung Volume Recruitment preset and deliver one or more recruitment breaths
11. If further treatment is required, consider patient fatigue and reassess effectiveness of treatment regimen in consultation with interdisciplinary team.
12. Upon completion, return patient/client/resident to comfortable position.
13. Clean any secretions from the end of the tubing. Pieces that have been in contact with secretions need to be discarded when working in the hospital.
    - Patients in the community/residential care can wash the pieces (excluding the bacterial filter) in warm water and detergent, allowing them to dry completely before next use as per the manufacturer. The bacteria filter cannot be washed and should be replaced if it is clogged.
    - Change the bacterial filter at least qweekly to prevent an increase in expiratory resistance, and any time it becomes visibly soiled with secretions. Write the date of the last change on the filter with black indelible ink.
14. Remove personal protective equipment and wash hands.

Expected Patient/Client/Resident Outcomes

The patient will clear secretions with the help of MI-E. The objective is to improve oxygen saturation; improve breath sounds on auscultation; and improve and/or reduce work of breathing. It may also aid in maintaining chest wall flexibility by using it for lung volume recruitment, preventing complication such as atelectasis.

Patient/Client/Resident Education

- The patient should be educated as to why they require MI-E to be performed and its expected outcomes.
- The patient should also be aware of the physical factors contributing to his/her inability to perform an adequate cough.
- During rehabilitation, a person with a spinal cord injury is educated about altered respiratory function, problem recognition, and treatment options. Part of the process is empowering the person to direct his or her own care, for example setting up the machine for the patient to use independently.

Evaluation

The patient should be evaluated to determine if expected outcomes have occurred. In the event that the patient's oxygen saturation, breath sounds on auscultation or work of breathing do not improve, an adjunctive or alternative form of secretion clearance should be considered, such as suctioning, breath stacking, manual hyperinflation, or intubation. For a review of chest physiotherapy techniques see Reid et al. 2009.

Documentation

The following should be documented in ID notes, nurse's notes (or other appropriate place):

- VS (SpO_2, HR, BP, RR)
- Pressures
- Time of inhalation
- Time of exhalation
- Whether the oscillatory setting was used
- Mode (manual or automatic, coughtrak yes/no)
- Number of breaths per cycles(sets) and number of cycles (sets)(for example 3 sets of 3 breaths)
- Amount of secretions
- Any client specific techniques
- Client's response to procedure
- Any related procedures (e.g. postural drainage, oxygenation, suctioning)
- Subsequent uses on same settings can be charted "as per Care Plan"
- With **every** use, clinician needs to chart PCF (Peak cough flow) and Insufflation Volume as part of your respiratory assessment
- Anytime MI-E settings changed, changes must be charted in RT or PT official charting and the Interdisciplinary Care Plan must be updated

Related Documents

VCH:

- Open Tracheostomy Suctioning (D-00-07-30105)
- Lung Volume Recruitment with a Modified Manual Ventilation Unit (D-00-12-30240)
- Oxygen Therapy and Respiratory Care Reference Manual (D-00-07-30238)
- Tracheal Suctioning - Closed System (D-00-12-30239)
- Pharyngeal Airways – Insertion, Removal and Tracheal Suctioning (D-00-12-30237)

VCH – PHC:

- Assisted Cough Techniques (BD-00-07-40004)

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Effective Date:	09-APRIL-2021	
Posted Date:	09-APRIL-2021	
Last Revised:	19-MAY-2021	
Last Reviewed:	09-APRIL-2021	
Approved By: *(committee or position)*	PHC	VCH
	Endorsed by: PHC Professional Practice Standards Committee	**Endorsed by:** (Regional SharePoint 2nd Reading) Health Authority Profession Specific Advisory Council Chairs (HAPSAC) Health Authority & Area Specific Interprofessional Advisory Council Chairs (HAIAC) Operations Directors Professional Practice Directors Vice President Professional Practice and Chief Clinical Information Officer, VCH
Owners: *(optional)*	PHC	VCH
	Team members: • Professional Practice Leader Respiratory Therapy • ICU Physiotherapist • Professional Practice Leader Physiotherapy	**DST Developer Lead(s):** • Physiotherapist, Clinical Resource Therapist, VCH • Respiratory Therapy Practice Leader, Professional Practice - Allied Health **Team Members:** • Practice Leader, Respiratory Therapy, Vancouver Acute • Practice Coordinator, Physiotherapy, VGH and G.F. Strong • Practice Initiatives Lead, Nursing, Professional Practice, Vancouver Acute • Regional Practice Leader - Physiotherapy Physiotherapy - Regional Professional Practice, VCH

Appendix A: Machine-Specific pictures

Phillips CoughAssist E70

Video detailing how to set up the Phillips CoughAssist device is available from the vendor: https://www.youtube.com/watch?v=QHdqcRYIkmU

Two filter set up:

One filter set up:

Appendix B: Performance Checklist - Mechanical Insufflation-Exsufflation (CoughAssist Machine)

Name: _____ Date: _____

Assessor: _____ Date & Worksite: _____

*Adequate training is defined as the training of the knowledge and skills required to perform this technique and the opportunity to apply the skill with mentorship from an instructor experienced in this technique.

The caregiver will perform the above skill consistent with the performance checklist and demonstrate knowledge of all principles, contraindications and precautions associated with performing this clinical skill.

The Caregiver Demonstrates	Check box	Comments
Understanding of the indications for performing mechanical insufflation-exsufflation (MI-E) • Ineffective cough due to neurological deficit (Intercostals and abdominals) • Need to clear secretions	☐ ☐	

Understanding of the contra-indications and precautions for performing MI-E
Contraindications
• Any patient with a history of bullous emphysema
• Patients with unresolved barotrauma or pneumothorax
Precautions
• Patients with impaired consciousness or difficulty communicating
• Susceptibility to pneumothorax or pnuemo-mediastinum/ high risk of lung injury
• Elevated ICP including ventricular drains
• Surgical interventions to thorax (e.g. sternotomy, thoracotomy, chest tubes)
• Requiring pressures greater than 40 cmH2O is <u>not a precaution</u> but **requires Physician Order**
• Unstable spine
  • Follow spinal precautions
  • Ensure you can maintain neutral alignment before proceeding
  • May require someone to hold head during procedure
• Unstable artificial airway
  • Ensure stability before proceeding
  ○
	☐
	
	☐	

Technique: • Clinical reasoning for required supplemental treatments identified • Able to review settings and ensure parameters are appropriate as recommended in care plan • Able to test pressures using steps above • Able to identify number of reps/sets recommended in care plan • Ongoing monitoring of tolerance of procedure e.g. SpO_2. • Able to appropriately clean and/or dispose of soiled tubing and filters.	☐ ☐ ☐ ☐ ☐ ☐	
The Caregiver Demonstrates	**Check box**	**Comments**
RT AND PT ONLY: Setting pressures • Able to get patients comfortable with technique • Able to write care plan (Appendix C) and obtain doctor's order as necessary • Able to set pressures to obtain sufficient inspiratory volume ("tidal volume" on digital machine) and peak cough flow and maintain patient safety/comfort • Clinical reasoning for settings used along with indicating other settings such as coughtrak, oscillation, changing timing	☐ ☐ ☐ ☐	
Evaluation of effectiveness of treatment: • Subjective report from client, amount of secretions cleared, SpO_2, decreased SOB, auscultation findings • Improved Peak cough flow, Vital capacity, or tidal volume	☐ ☐	

Assessor Sign Off: Date:

_____ _____

Appendix C: Mechanical Insufflation–Exsufflation Device (Mi-E) Bedside Care Plan

This document is available for printing in cardstock paper weight
Order number: (BCHA.0222).

MECHANICAL INSUFFLATION–EXSUFFLATION DEVICE (MI-E) BEDSIDE CARE PLAN

A copy of this Care Plan should be kept at the patient's bedside

Date: _____

Interface: ☐ Mask ☐ Mouthpiece ☐ Airway adaptor

Frequency of Treatments:

Bronchial Hygiene: _____

Lung Volume Recruitment: _____

Setting	Bronchial Hygiene Preset # _____	Lung Volume Recruitment Preset # _____
Mode		
Coughtrak (On/Off)		
Insufflation Pressure		
Inspiratory Time (Ti)		
Flow		
Expiratory Time (Te)		
Exsufflation Pressure		
Pause Time	Set to Zero	Set to Zero
Oscillations (On/Off)		None
Pre-Therapy Breaths (Advanced Auto)		N/A
Pre-Therapy Breaths Pressure (Advanced Auto)		N/A
Pre-Therapy Flow (Advanced Auto)		N/A
Pre-Therapy Time (Advanced Auto)		N/A
Pre-Therapy Pause (Advanced Auto)		N/A
Number of Cycles (Advanced Auto)		N/A
Post-Therapy Breath	Always OFF	N/A

TREATMENT IS: _____ sets of _____ breaths with a 30 second pause between sets;

followed by _____ breaths for recruitment

Instructions:

- Turn on the machine and check the settings before proceeding
- Test the pressures by running the machine through a complete breath before using with the patient
- To start the treatment press the "therapy" button and the machine will start a breath in
- Let the client cough secretions up into the tubing if able. Do not stop the treatment until the breath out is finished. If secretions are coughed up into the tubing, pause the machine after exhalation and clear the secretions.
- To stop the treatment press the "standby" button
- For patients who have issues with bradycardia and autonomic dysreflexia, start with fewer breaths and shorter Ti until safe settings are established

Signature: _____ Printed name: _____

MECHANICAL
INSUFFLATION–EXSUFFLATION DEVICE (MI-E)
BEDSIDE CARE PLAN

Mechanical Insufflation-Exsufflation (MI-E) Recommended Settings

Setting	Bronchial Hygiene	Lung Volume Recruitment
Mode	Auto or Advanced Auto	Auto or Manual
Number of Breaths	3 to 5 Sets of 3 to 5 breaths	1 breath, repeat as per patient
Coughtrak	ON/OFF (Auto), OFF (Adv. Auto)	ON/OFF
Insufflation Pressure	First session start at 10 to 15 cmH_20 Minimally effective at 30 cmH_20 and most effective at 40 cmH_20 Obtain order for pressure greater than 40 cmH_20	Identify maximal comfortably tolerated pressure (greater than 30 cmH_20) Obtain order for pressure greater than 40 cmH_20
Inspiratory Time (Ti)	2 to 3 seconds	2 to 5 seconds (Slowly extend inhale time to maximum and comfortable time)
Flow	Low to high (patient comfort)	Low to medium
Expiratory Time (Te)	Same as inspiratory time or shorter to assist with cough	Same as Ti if more than 1 cycle desired Minimum 5 seconds if only 1 cycle desired
Exsufflation Pressure	First session start at -10 to -15 cmH_20 Minimum -30 cmH_20 Goal -40 cmH_20 Obtain order if more exsufflation pressure required	Zero (patient able to passively exhale)
Pause Time∗	Zero	Zero
Oscillations	As per patient In Advanced Auto mode, if oscillations are set on Insufflation, oscillations will also be delivered during pre-therapy breaths	None
Pre-Therapy Breaths (Advanced Auto)	3 to 10 breaths	N/A
Pre-Therapy Breaths Pressure (Advanced Auto)	20 to 40 cmH_20	N/A
Pre-Therapy Flow (Advanced Auto)	As per patient feedback	N/A
Pre-Therapy Time (Advanced Auto)	2 to 4 seconds (as per patient tolerance)	N/A
Pre-Therapy Pause (Advanced Auto)	2 seconds	N/A
Number of Coughs	1 to 4	N/A
Number of Cycles (Advanced Auto)	1, then reassess if patient needs more (MI-E will go into standby after 1)	N/A
Post-Therapy Breath	None (utilize Lung Volume Recruitment settings)	N/A

∗Always set Pause Time to Zero. Setting a Pause delays the patient's ability to take a breath in or out