



Technique Title: Installation, use and verification of an In-Exsufflator device

Edition: Public

Date: May 2016

Disclaimer & Accuracy

This information is provided to you for educational purposes only and should not at any time be considered as a substitute for professional advice from a physician or other qualified health care professionals. The NPHVA does not assume any responsibility for injuries, losses or damages directly or indirectly sustained following the information provided in this document. We have taken every care to ensure that the information contained in this document is accurate, complete and kept up-to-date. However, medical and technical knowledge is constantly changing and we cannot guarantee that all of the information is accurate and consistent with current practices.

PURPOSE: Assure secure use of the In-Exsufflator device for ventilo-assisted adult or pediatric home users that require cough assistance.

Important: Introduce an In-Exsufflator device only when all other conventional cough assistance techniques have been tried (with or without a manual resuscitator).

DESCRIPTION: An In-Exsufflator is a pressure device that fills up the lungs by a quick insufflation followed by a decompression (quick Exsufflation). This pressure drop (often from +40 cm H₂O to -40 cm H₂O) induces effective drainage of pulmonary secretions. The insufflation and exsufflation pressures can be adjusted to the patient's comfort and maximizes secretion mobilization efficiency.

An In-Exsufflator is an external maneuver that uses a positive pressure device assisting the normal expectoration process for adult or pediatric patients that demonstrate weaknesses in the inspiratory muscles (diaphragm, external intercostal) and/or expiratory muscles (larynx, internal intercostal, abdominal muscles). This maneuver serves as an alternative and/or as a complementary treatment to traditional invasive aspiration with a suction catheter for patients with or without a tracheostomy.

This treatment also aims to:

- Prevent Atelectasis (augmentation of pulmonary volumes);
- Increase cough efficiency;
- Increase mechanical compliance;
- Optimization of thoracic cage mobility;
- Increase voice strength;
- Improve gas exchanges.

WARNING!

Never use oxygen with the CA-3000 In-Exsufflator. There is a potential explosion risk associated with the device's mechanical movements when it generates quick fluctuations between positive and negative pressures.

N.B.: Oxygen may be used with the E-70.

CONTEXT: Technique related to the installation, use and verification of the In-Exsufflator device for adult or pediatric ventilo-assisted patients at home. This technique serves as a reference guide when teaching patients, their family or other caregivers.

Important: This technique is favoured only when other insufflation techniques (manual resuscitator, mouth-piece ventilation or RGP) do not produce an adequate cough pressure (PCF 270L/min) or when the patient has abundant chronic secretions and/or when the patient cannot apply other techniques due to a lack of coordination or glottis control.

N.B.: Patients using an In-Exsufflator must have received training and necessary supplies for an assisted cough technique with the use of a manual resuscitator in case of travelling or power loss.

Please note that an NPHVA collective prescription or individual medical prescription is required before starting this therapy. Furthermore, therapy efficiency must be regularly evaluated.

INDICATIONS: The use of an In-Exsufflator is primarily indicated for patients with restrictive and neuromuscular diseases who have weaknesses or a mechanical incapacity of their respiratory muscles which causes difficulty to cough and expectorate their chronic pulmonary secretions. (Peak Cough Flow <270 LPM; predicted Forced Vital Capacity [FVC] <50%).

A cough assisted treatment must be integrated into the patient's therapeutic plan according to one or more of the following conditions:

- As a **preventive** treatment to prevent:
 - Pulmonary infections;
 - Atelectasia;
 - Development of mucous plugs;
 - Progression of thoracic rigidity.

The patient must have one or more of the following conditions:

- Patients receiving a non-invasive ventilation due to respiratory muscle weakness;
 - Patients who often experience congestion as well as a difficulty to cough and expectorate their secretions;
 - Presence of bulbar signs suggesting an increased aspiration risk (recent signs of dysphonia, husky or humid voice, hypersalivation, reduced cough reflex, decreased gag reflex);
 - Presence of thick secretions, sticky and/or mucous plugs without patient dehydration or a diminished humidity level in inhaled air.
- As a **therapeutic** treatment:

The patient must have one or more of the following conditions:

 - Patients suffering from chronic congestion with difficulty coughing and expectorating his secretions;
 - Presence of respiratory infections with diminished muscular force (PCF <270L/min);
 - New atelectasia (Ex.: following an infection), in order to recruit the part of the atelectasied lung.

ABSOLUTE COUNTER-INDICATIONS:

- Patient's refusal;
- Severe respiratory distress;
- Recent hemoptysis;
- Pneumothorax or recent hemothorax, chest tube (<3 months);
- Cardiac instability, de novo arrhythmia;
- Increased intracranial pressure and presence of ventricular drains;
- Recent ocular, thoracic or abdominal surgery (<3 months);
- All types of aneurisms (abdominal, cerebral).

RELATIVE COUNTER-INDICATIONS: Use with caution* with the following patients:

- Cognitive impairment preventing them from treatment collaboration;
- Known cardiac problems;
- Severe bulbar symptoms (gag reflex absence, vocal cord paralysis, problems swallowing);
- Patients with severe kyphoscoliosis;
- Patients with thoracic pain or who are out of breath during the treatment;
- Patients who are at risk of pneumothorax, such as patients with emphysema or recent thoraco-traumatism;
- Lack of coordination preventing the patient from adequately performing the technique;
- Oral occlusion problems or facial mask leaks;
- Presence of inter-thoracic or abdominal tubes;
- Nausea;
- Pregnancy.

* *Gradual pressure increase; monitor vital signs and patient comfort.*

Clinical judgment is required to evaluate and judge treatment efficiency versus patient discomfort and fatigue.

OTHER CONSIDERATIONS:

The patient and his family must receive information* on how to properly use the In-Exsufflator and emphasize the following conditions:

- Verify, maintain and use the device appropriately;
- Treatment efficiency evaluation;
- Applying disinfection measures/cleaning;
- Recognize pulmonary infection signs and symptoms.

**Validation of patient, family and other caregiver knowledge must be regularly reviewed per the respiratory therapist's judgment, after assessment or on an as-needed basis.*

N.B.: A review of all teaching information must be performed at least once a year.

REQUIRED MATERIAL:

- NPHVA collective prescription or individual medical prescription;
- In-Exsufflator;
- Interface (mask, mouth piece or tracheal connector);
- Nose clip, if needed;
- Tubing;
- Antibacterial filter;
- Suction unit (if required);
- Manual resuscitator (if required).

OTHER REQUIRED MATERIAL:

- NPHVA "patient teaching guides", as well as all manufacturers didactic material;
- Patient's home ventilation record.

TECHNIQUE DESCRIPTION:

1. Wash your hands with antiseptic soap or antiseptic hand sanitizer;
2. Evaluate patient (auscultation, pulse, B/P, at rest saturation) ;
3. Ask the patient the time of his last meal. It is recommended to perform this cough assistance maneuver 2 hours after the patient's last meal in order to avoid gastric discomfort or regurgitation;
4. Position the patient so he is comfortable and secure. Make sure that the patient's head is properly positioned and held. A sitting position is preferable to promote diaphragmatic movement, but the technique can also be done lying down;
5. Select the interface best suited to the patient's needs (mouth piece, mask or tracheal adapter*) and connect it to the In-Exsufflator. Use a nose clip if there are too many leaks when a mouth piece is used.

***FOR PATIENTS WITH A TRACHEOSTOMY**

The technique can be used with the following precautions:

Apply this technique with an inflated or deflated cuff depending on the patient's use. (Ex.: use an inflated cuff if the patient always uses a deflated cuff.)

Warning: *pulmonary pressures risk being elevated with an inflated cuff. Contrary, when the cuff is deflated, the device has higher pressures to compensate for leaks.*

- Make sure that the external cannula (part with the flanges) **is fixed securely around the patient's neck with tie strings or other measures;**
- Make sure you have a suction device with catheter available at all times;
- Establish a signal with the patient (if possible), which indicates that he feels discomfort or pain;
- If presence of a tracheostomy with cuff, always have at hand a 10 cc syringe;
- Always start with low pressures and gradually increase them following the NPHVA collective prescription or individual medical prescription. Adjust for patient comfort/tolerance and treatment efficiency.

Other possible techniques:

If the patient has a tracheostomy cannula without a cuff in place, or if the technique is done with a deflated cuff, you can block the cannula with a red cap and use a facial mask or mouth piece with a nose clip to administer the treatment.

WARNING! Make sure that the superior airways are clear and that air passes well. Immediately remove the red cap at the end of the treatment or before, if you need to re-inflate the cuff.

Important:

Evaluate the risk management of the technique that will be done, according to the patient's physical and intellectual capacities, as well as their caregivers, and the efficiency of the treatment and patient comfort.

6. Adjust the In-Exsufflator following the listed recommendations stipulated below as well as the NPHVA collective prescription or individual medical prescription;

General Adjustments

Automatic or Manual Mode:

Validate the adjustments with the care giver that will administer the treatment. In manual mode, the Ti/Te and pause time will be determined by the caregiver. In automatic mode, you must set the Ti/Te and pause time.

Inspi/Expi Pressure Adjustments:

It is recommended that during initiation, start with lower pressures and gradually increase depending on patient tolerance, therapy efficiency, as well as the NPHVA collective prescription or individual medical prescription.

Ti/Te Adjustments:

Adult: between 2–4 seconds, if slow inspiratory flow, favours between 3–4 seconds; Pediatric: between 1–2 seconds.

Flow Adjustment:

Depending on patient comfort, the flow can be set at Low, Medium or High setting;

It is recommended to start with a low flow during initiation and then gradually increase.

Pause Time:

If manual mode is used, this parameter should not be adjusted.

In automatic mode, depending on patient comfort, set the pause time between the end of the exhalation and before the beginning of inspiration between 0–5 seconds.

N.B.: For the E-70, if the Cough Track is “On”; there is no pause time to adjust.

In exhalation phase, it is suggested to encourage the patient to cough to help clear his secretions. This does not apply when oscillations are being used.

E-70 Adjustments

Cough Track:

Validate that the patient is able to trigger it; ask him to inhale and verify that the treatment has started. If he is not able to initiate the treatment, this option cannot be used.

Oscillation:

Adjust for patient comfort and treatment efficiency (secretion mobilization);

- Amplitude: 5–10 cmH₂O;
- Frequency: 5–10 Hz.

Try oscillations in Inspi and Expi. Verify oscillation efficiency in both phases. If efficient in only one phase, set that phase (Ex.: Expi). If efficient in both phases, leave the setting at “Both”.

How to validate oscillation efficiency?

Validate if the oscillations are visible at the thorax level and/or if you can hear secretion mobilization. Ask the patient to confirm your observations (felt oscillation efficiency).

3 Preset adjustments:

- The presets 1 and 2 can be used for different patient needs, example:
 - With oscillations;
 - Without oscillations;
 - Alveolar recruitment only with Inspi pressures;
 - Either using different Inspi-Expi pressure settings, allowing users to familiarize themselves with the treatment.
- The 3rd preset must be used as an emergency preset, Ex.: superinfection, mucus plugs. With this setting, it is often necessary to use superior pressures for daily treatment. Sometimes a higher expiratory pressure is necessary to help remove patient secretions.

Important: It is preferable that Cough Track not be used in emergency mode.

ATTENTION: In cases of severe thoracic pain or significant dizziness, immediately stop the treatment and inform your referring physician.

Lung Volume Recruitment (LVR) Technique

It is possible to apply this technique with the E-70. You must set:

- An inspiratory pressure between 35–50 cmH₂O to allow the thorax to reach its maximal amplitude;
- A longer Ti, set between 2–4 seconds to allow pulmonary recruitment level;
- An expiratory pressure at “0”.

This technique is suggested as a preventive treatment.

To incorporate if:

- The technique is already known and used by the patient (Ex.: with LVR and manual resuscitator);
- If you need to preserve thoracic cage flexibility.

N.B.: Tolerance and patient comfort towards this therapy is fundamental while establishing the E-70 technique.

TECHNIQUE DESCRIPTION (cont'd)

7. Before starting, establish a signal with the patient that will allow you to communicate during the therapy;
8. Ask the patient to stay passive and let the In-Exsufflator device fill his lungs without any resistance;
9. Activate the In-Exsufflator and give only 1 sequence (Inspi-Expi) to allow the patient to learn how to manage the received pressures;
 - *It is recommended to use lower pressures during the initiation allowing the patient to adapt to the therapy.*
10. When well tolerated, give 2 consecutive sequences and gradually increase the pressure levels;
11. If needed, evaluate the patient's need to catch his breath between each sequence. Set a pause time or Cough Track option and if needed, readjust the Ti/Te (see above recommendations);
12. Evaluate the need or efficiency of using oscillations (see above recommendations);
13. When the best therapy corresponding to the patient's needs is set, repeat this cycle* for 4–6 cycles or until all the secretions are mobilized towards the back of the throat where they can be swallowed, coughed or, if needed, suctioned;
14. Do not execute more than one session (4–6 cycles) every 10 minutes to avoid patient hyperventilation;
15. Evaluate the need to adjust the E-70 presets (see the above recommendations in E-70 Adjustments);
16. If needed, evaluate the need to insert the LVR or MAC notion;
Note: The MAC can be combined to the therapy via In-Exsufflator to increase cough efficiency. However, it cannot be used with oscillations, since this would hinder its efficiency.
* (1 cycle = 4–5 sequences.)
17. Teaching (reasons for therapy, security measures, maintenance, mounting verification, pulmonary infection signs/symptoms, emergency measures);
18. Give the patient the “Patient Guide” documentation in his “home ventilation binder”.

N.B.: You must evaluate during each home visits all the different parameters that have been adjusted on the In-Exsufflator, validating treatment efficiency and its usage. It can be necessary to increase certain parameters following the patient's therapy adaptation and the illness evolution.

REFERENCES:

- Bach, J.R et al., 1993. Airway Secretion Clearance by Mechanical Exsufflation for Post-Poliomyelitis Ventilator-Assisted Individuals. Arch Phys Med Rehab, Vol 74, February, 170–177.
- DA McKim, J Road, M Avendano, et Al; Canadian Thoracic Society Home Mechanical Ventilation Committee. Home mechanical ventilation: A Canadian Thoracic Society clinical practice guideline. Can Respir J 2011; 18 [4]:197–215.
- Cochrane Collaboration; Mechanical insufflation-exsufflation for people with neuromuscular disorders, 2013
- Ottawa Rehabilitation Center: www.canventottawa.ca, Mechanical Insufflation-Exsufflation (MI-E), 2014
- Chiner E, Sancho-Chust JN, Landette P, Senent C, Gómez-Merino E. Técnicas complementarias a la ventilación mecánica domiciliaria. Ano SEPAR 2014. Arch Bronconeumol. 2014; 50:546-535.
- British Thoracic Society Respiratory Management of Children with Neuromuscular Weakness Guideline Group, Guidelines for Respiratory management of children with neuromuscular weakness, Thorax 2012; 67:i1-i40/thoraxjnl-2012-201964

GLOSSARY:

PCF: Peak Cough Flow
RGP: Respiration Glossopharyngeal
LVR: Lung Volume Recruitment
MAC: Manually Assisted-Cough

Authors:

Véronique, Adam, RRT, Training and Development Consultant
Rita Troini, RRT, MA

Consultants:

Dr. Marta Kaminska, Medical Director, Adults
Dr. David Zielinski, Medical Director, Pediatrics
Valérie Tétreault, RRT, Clinical Coordinator