Scope: Departmental
Document Type: Clinical Practice Guideline
Approved on: 2024-10-04
Next Review Date: 2027-10-04

The Use of Vibrating Mesh Nebulizer for the Delivery of Salbutamol within the Emergency Department (ED) and In-patient Wards

Version: 1

1.0 Introduction

This guideline applies specifically to Respiratory Therapy clinical practice for the wheezing patient receiving salbutamol within the Emergency Department (ED) or in-patient ward who is not benefitting from, or not able to use, a small-volume (jet) nebulizer or MDI. In the rare occurrence, a vibrating mesh nebulizer (VMN) may be used in the ED for ventilated patients.

Objectives

- To guide the respiratory therapist (RT) and most responsible physician (MRP) or their delegate in deciding which patient is suitable for using a vibrating mesh nebulizer (ex. Aerogen® Solo Nebulizer).
- To ensure the proper assembly and application of the VMN by the RT.
- To standardize patient assessment and documentation by the RT.

2.0 Definitions

- Salbutamol: A short-acting bronchodilator (Beta-2 agonist) indicated for use in patients with asthma to relieve acute chest tightness, wheezing and coughing.
- Aerogen® Solo Nebulizer: A disposable vibrating mesh nebulizer used to convert liquid into aerosol droplets. This type of nebulizer is an ideal aerosol generator in its stability of optimal particle size and adds no extra flow. In the ED, the VMN may be used for the patient who is spontaneously breathing, or who is receiving non-invasive ventilation, or invasive ventilation. On the in-patient ward the use of VMN is for the spontaneously breathing patient or the patient receiving non-invasive ventilation.
- Aerogen® Pro-X Controller: The electrical device that powers the nebulizer; has a 45-minute internal battery when fully charged (green light), and two settings: 30-minute and continuous.
- Aerogen® Ultra: A handheld device that can be used with the Aerogen® Solo Nebulizer to deliver inhaled medication via mask or mouthpiece
- Metered-dose Inhaler (MDI): a pressurized canister that contains a medication and a propellant. Actuation of the MDI results in the ejection of one metered dose of medication as aerosolized particles, which is then inhaled by the patient (spontaneously or by positive-pressure ventilation). An MDI is commonly referred to as a "puffer".

- Spacer Device/Valved Holding Chamber (VHC): Valved holding chamber and spacer device can be used interchangeably to describe an accessory device used with an MDI. The spacer device is an effective way to use the MDI. These devices help decrease the velocity of the particles to improve drug delivery within the lungs. They also alleviate the need for a coordinated action between the release of the medication and inhalation. The spacer device can be used with a mouthpiece or a mask interface depending upon the patient's ability to form a seal with the mouthpiece (e.g. AerochamberTM).
- Small Volume Nebulizer: device used to convert a suspension of particles into an aerosol to facilitate delivery to respiratory tract for therapeutic purposes.

3.0 Policy

- A medical order for salbutamol is required.
- The RT will be responsible for the set-up of the salbutamol and nebulizer, including the placement of the nebulizer into any respiratory technology that is in use.
- The RT is responsible for ensuring the verification of the medical order, administration of the salbutamol and visualization/verification of nebulization.
- All nebulized therapy requires droplet/contact precautions to be initiated during treatment.
- Prior to initiating Aerogen® and Solo neb in the ED or in-patient ward, the RT must discuss the treatment plan with the MRP or their delegate, the Charge or Clinical Support RN, and bedside RN.

4.0 Guideline

4.1 Target Population in the Emergency Department

4.11 Use of Solo nebulizer with Ultra (mask or mouthpiece interface)

- Patients receiving salbutamol via MDI or SVN, whose status is not improving despite following the Emergency Department Asthma Order Set.
- For the wheezing patient who requires supplemental oxygen during salbutamol delivery via SVN but will not tolerate/is not able to wear a mask (ex. Patient with facial burns or trauma, patient with sensory issues, etc.).
- If able, once patient status improves, these patients should be promptly transitioned from Aerogen® to MDI or SVN, ideally for the next 2 doses, prior to transfer to an in-patient ward.

4.12 Use of Solo nebulizer with In-line T-piece to Heated High Flow (HHF), NPPV or Invasive Ventilation

- For the wheezing patient who is not able to come off heated high flow, non-invasive or invasive pressure ventilation (ex. for palliation) for inhaled medication delivery

- For patients who are suitable for admission to the CCU, they may continue to have the VMN in-line with the above therapies and the MRP team must be made aware.
- If able, once patient status improves, these patients should be promptly transitioned from Aerogen® to MDI or SVN, ideally for the next 2 doses, prior to transfer to an in-patient ward

4.2 Target Population on the In-patient Wards

In-patient ward use of vibrating mesh technology should be the exception but may be considered for the following:

4.21 Use of Solo nebulizer with Ultra (mask or mouthpiece interface)

- For the poorly responding patient being managed per the Inpatient Management of Acute Asthma Exacerbation guideline.
- For the wheezing patient who requires supplemental oxygen during salbutamol delivery via SVN but will not tolerate/is not able to wear a mask (ex. Patient with facial burns or trauma, patient with severe sensory issues, etc.).

4.22 Use of Solo nebulizer with In-line T-piece to NPPV

- For the wheezing patient who is not able to come off non-invasive pressure ventilation (ex. for palliation) for inhaled medication delivery and is not a candidate for admission to the Critical Care Unit.

The RT continues to follow and play an active role in medication delivery and assessment, ensuring prompt discontinuation of Aerogen® and transition to MDI or SVN as soon possible for a patient on the ward

4.3 Considerations for the Patient Receiving Heated High Flow Nasal Canula (HHFNC)

- Administration of medications through respiratory devices and interfaces has limitations.
- When therapeutic flowrates are being delivered to the patient via HFNC, in-line delivery of salbutamol via Solo nebulizer provides a small fraction of the inhaled dose to the patient.
    - To maximize dose delivery to the patient on HFNC in the ED, the flowrate should be appropriately decreased for the duration of the nebulization, with RT present to monitor and assess patient status. HFNC flowrate should be titrated up to previous levels once nebulization is complete.
- Due to current monitoring and staffing limitations, decreasing the HFNC flowrate on the in-patient ward to deliver in-line salbutamol via Solo neb is not an approved practice.
- For those patients receiving HFNC on an in-patient ward, the nasal canula should either be lifted from the nares or removed completely during delivery of inhaled medication via SVN, MDI or Solo neb with Ultra.
- Nebulization is not to be in-line with the HFNC circuit on an in-patient ward.

5.0 Procedure

Equipment

- Personal Protective Equipment (PPE)
- Aerogen® Solo Nebulizer
- Aerogen® Pro-X Controller
- Aerogen® Ultra
- Salbutamol as prescribed by the MRP or delegate
- Syringe and blunt-tip needle if needed
- Syringe label if needed

Important Steps	Key Points
1. Wash hands, gather equipment, and don PPE.	• Please see Hand Hygiene and Hand Care • Please see Droplet/Contact Precautions
2. Identify patient. Explain the procedure to the patient and/or caregiver and gain consent.	• Please see Patient Identification • Please see Consent to Treatment • Review the steps and length of the procedure. • Allow the child the opportunity to handle or see the equipment if helpful.
3. Prior to each treatment, assess the patient, including vital signs, SpO2, auscultation, and work of breathing. Document the assessment in the patient record.	• Baseline information will identify any change in clinical status and infant/child's response to treatment. • For intubated and ventilated patients, flow waveforms, tidal volumes, and airway pressures may provide objective criteria for assessment.
4. Position patient for optimal delivery of the medication. For the infant: Have the caregiver or HCP cradle and support the infant at an upright position of greater than 45 degrees. For the child: Have the child sit upright at greater than 45 degrees.	• Nebulizer should always be in upright position during administration of medication. • Infants should not use a soother during the inhalation if possible.
5. Gather the equipment for delivery of salbutamol.	A) For patients using Ultra: • Obtain Aerogen® controller, Solo neb, Ultra and interface (mask or mouthpiece), O2 tubing (if supplemental O2 needed)

Important Steps	Key Points
	B) For patients on NPPV and PPV: •Obtain Aerogen® controller, Solo neb, t-piece and filter
6. Set-up equipment a) Aerogen® Ultra & Solo Neb • Patient must be spontaneously breathing • Can use with mouthpiece or mask • For patients with an FiO2 requirement, oxygen tubing can connect to the oxygen port for delivery of supplemental oxygen during treatment. O2 flowrate should be set between 1-6lpm.	Aerogen Ultra Instruction Manual Video: Ultra with Mask Set-up Video: Ultra with Mouthpiece Set-up  *Figure 1: Ultra set up with mouthpiece (can use mask if needed) for the spontaneously breathing patient.* *https://youtu.be/s_djerucmDg*
b) Aerogen® Solo Neb on Dry Side of Humidifier for Non-invasive or Invasive Ventilation • Nebulization will not affect ventilator flow rates or delivered pressures. • No mode change is necessary when using the vibrating mesh nebulizer, as ventilation remains unaffected. • Install a filter between expiratory limb and ventilator.	Video: Dry Side of Humidifier Set-up  *Figure 2: Solo neb and connector to DRY side of humidifier pot for patients requiring ventilation.* *https://youtu.be/wZPTnLd6ePQ*

Important Steps	Key Points
7.Prepare medication for delivery. Add medication to the Solo neb and prepare/connect equipment for therapy. • Draw up salbutamol dose as ordered (using syringe and blunt-tip needle if necessary) • Open rubber stopper on Solo neb • Place the salbutamol in the Solo neb chamber and close rubber stopper on Solo neb • The total volume of salbutamol in the Solo neb chamber must not exceed 6 mL.	• Please see Administration of Medication • Discard syringe and blunt-tip needle after use. • Refer to e-Formulary as required.
8. Turn on the controller for the nebulizer.	• A fine mist should be visible in the Solo neb  *Figure 3: Visualization of misting in nebulizer confirms function.* *https://youtu.be/s_djerucmDg*
9. Monitor patient during nebulizer therapy. •Treatment ends when the mist has stopped. •Remove the interface and disconnect the nebulizer equipment. •Turn the controller off once treatment ends. •The vibrating mesh nebulizer can be left in line once treatment is completed.	• During delivery, be sure to assess the effectiveness of the treatment, and the patient's tolerance. •Identify any changes in clinical status and be sure document as part of the assessment.
10. Assess patient response to nebulizer therapy, including vital signs, SpO2, auscultation, and work of breathing after the treatment.	• It is important to assess the effectiveness of the treatment and to identify any changes in clinical status. • Bronchodilators may cause tachycardia, palpitations and tremors.

Important Steps	Key Points
12.Remove PPE and wash your hands	• Please see Hand Hygiene and Hand Care • Please see Routine Practices
13.Document the medication administration and the patient's response to treatment in the patient record.	•Medication delivery documentation via the MAR •RT to document respiratory assessment via the flowsheet

6.0 Related Documents

Administration of Medication

Droplet/Contact Precautions

Nebulizer Aerosol Therapy

General Oxygen Therapy

Inpatient Management of Acute Asthma Exacerbation

Heated High Flow Nasal Canula Therapy

Continuous Salbutamol Therapy

7.0 References

Arzu A, Fink JB. Recent advances in aerosol devices for the delivery of inhaled medications. Expert Opinion on Drug Delivery, 2020, 17:2, 133-144. DOI: 10.1080/17425247.2020.1712356.

Dhand R. How Should Aerosols Be Delivered During Invasive Mechanical Ventilation? Respiratory Care October 2017, 62 (10) 1343-1367; DOI: https://doi.org/10.4187/respcare.05803

Gardenhire DS, Burnett D, Strickland S, Myers TR. A Guide to Aerosol Delivery Devices for Respiratory Therapists (4th ed.) 2017. American Association for Respiratory Care. Accessed Jan 11, 2021, from: https://www.aarc.org/wp-content/uploads/2015/04/aerosol_guide_rt.pdf

Gregory MA, Elliott MN & Dunne MR. (2024, September 10). Retrieved from Aerosol Delivery Devices for Physicians, Nurses, Pharmacists, and Other Health Care Professionals: https://www.aarc.org/wp-content/uploads/2023/06/aerosol_guide_for_HCPs_4th_ed.pdf

AerogenLtd August 2024 http://www.youtube.com/@AerogenLtd