

## B03: Asthma and Bronchospasm

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Reviewed:

### Introduction

Bronchospasm is the constriction of the smooth muscles of the bronchi, resulting in narrowing and obstruction of the lower airways. The hallmark of bronchospasm is a cough with generalized wheezing, although in severe cases there may be little or no air movement, and correspondingly little wheeze. The bronchospasm can inhibit proper ventilation, provoking air trapping, and can also cause an increase in respiratory secretions leading to mucus plugging, worsening air flow in the lungs. Asthma is a disease marked by frequent and reversible episodes of bronchospasm resulting from characteristic patient-specific triggers.

### Essentials

- All nebulized medications are discontinued. Metered dose inhalers (MDIs) and spacers can be used in the place of nebulized salbutamol and ipratropium bromide. See the BCEHS Handbook for dosing of these medications. Salbutamol is the medication of choice for an acute asthma attack. Addition of ipratropium bromide has been demonstrated to improve bronchial flow and alleviate symptoms.
- Due to world-wide shortages of some medications, paramedics are asked to use a patient's own prescribed salbutamol MDI, providing it is in working order and in date. Bring the patient's salbutamol MDI to the hospital for ongoing use.
- Epinephrine via intramuscular injection should be considered for a patient with SpO<sub>2</sub> <90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by metered dose inhalers.
- Continuous positive airway pressure (CPAP) is available as an option to optimize oxygenation in patients who have already received bronchodilator therapy.
- CPAP should be used with extreme caution. Paramedics will wear airborne PPE when administering CPAP. If possible, CPAP should be discontinued prior to entering the emergency department and resumed when the patient is in an appropriate patient care area (i.e. negative pressure room).

### Additional Treatment Information

- **WARNING: CONSIDER THE RISK OF INFECTIOUS DISEASE EXPOSURE WHEN PERFORMING INTERVENTIONS THAT PRODUCE AEROSOLS. ALL NEBULIZED MEDICATIONS ARE DISCONTINUED. METERED DOSE INHALERS (MDIS) AND SPACERS CAN BE USED IN THE PLACE OF NEBULIZED SALBUTAMOL AND IPRATROPIUM BROMIDE. SEE THE BCEHS HANDBOOK FOR DOSING OF THESE MEDICATIONS.**
- Bronchospasm is a disease of ventilation. Although the oxygen saturation may be low, this is a result of alveolar hypoventilation and does not necessarily represent a fundamental failure of oxygen uptake or delivery. Do not over-focus on oxygenation to the exclusion of ventilation. Recall that the elimination of carbon dioxide from the body depends on minute ventilation (which is in turn based on tidal volume and respiratory rate). Critical hypercarbia can develop in severe asthma; the patient's level of consciousness and respiratory effort must be monitored closely, and aggressive action taken to support ventilation if deterioration becomes evident.
- Signs of impending respiratory failure include decreased air entry and respiratory effort, fatigue, falling level of consciousness, and slowing respiratory rates.
- Salbutamol often provokes coughing, and may temporarily worsen audible bronchospasm. Allow the medication to run its course before making additional treatment decisions, unless the patient is deteriorating rapidly. In some cases, repeated MDI therapy can be beneficial in optimizing drug delivery to the tissues of the bronchi; it should be considered if the patient continues to be significantly short of breath, but able to ventilate effectively, following the initial dose of salbutamol.
- Ipratropium is an anticholinergic agent that reduces airway secretions and acts synergistically with salbutamol as a bronchodilator. Its activity is limited to the lung parenchyma and there is little risk of systemic toxicity. PCP crews are able to transport patients who have received ipratropium provided the medication has completed its course.
- Epinephrine as an adrenergic agonist can produce dramatic bronchodilation in critically ill patients. Epinephrine should be used preferentially if the cause of the bronchospasm is believed to be anaphylaxis (see anaphylaxis CPG for more details).

- Magnesium sulfate, given intravenously, can produce bronchodilation through relaxation of smooth muscle. Its use should be reserved for patients with acutely exacerbated asthma rather than decompensated chronic obstructive pulmonary disease.
- **Cardiac arrest considerations:** for all asthmatic patients in cardiac arrest, and especially for patients in whom ventilation is difficult, the possible diagnosis of a tension pneumothorax should be carefully considered and treated with extreme caution.

## Referral Information

Patients with single episodes of bronchospasm and a well-established history of disease, where control of breathing is obtained quickly with a short course of inhaled bronchodilators, may be referred for follow-up in consultation with CliniCall. Patients with increasingly frequent episodes of bronchospasm, disease that is poorly controlled in the opinion of the paramedic, a consistent inability to access or use rescue inhalers, or an inability to return to their own baseline, should be transported to hospital.

## General Information

- Signs of a severe asthma exacerbation include: tachypnea (>30 breaths/minute); tachycardia; inspirational accessory muscle use; diaphoresis; unable to speak in full sentences; unable to lie supine. Note that not all patients with severe bronchospasm will exhibit these signs.
- Patients with bronchospasm typically have a prolonged expiratory phase, often 2-3 times longer than their inspiratory phase. This is the result of the effort required to exhale against the constricted airways. In the absence of audible wheezes in a patient who is visibly short of breath, consider the inspiratory-expiratory ratio as an additional piece of information.
- Patients should be asked about their history of disease, with specific focus on previous hospital visits or admissions for asthma and current prescription drug use (including corticosteroids and bronchodilators). A history of repeated hospital visits for asthma, with or without a concurrent history of increasing bronchodilator use, is predictive for severe disease and places the patient at risk for heightened mortality.

## Interventions

### First Responder

- Position of comfort for patient.
- Supplemental oxygen to maintain SpO<sub>2</sub> ≥ 90% (caution: may not be achievable).
  - → [A07: Oxygen and Medication Administration](#)
- May assist patient with own MDI and spacer.

### Emergency Medical Responder – All FR interventions, plus:

- Transport early.
- Consider ACP intercept.

### Primary Care Paramedic – All FR and EMR interventions, plus:

- [Salbutamol](#) via MDI with spacer.
- For severe disease progressing to imminent respiratory failure: consider intramuscular [EPINEPHrine](#) (mandatory CliniCall consult). Epinephrine via intramuscular injection should be considered for a patient with SpO<sub>2</sub> <90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by MDIs.
- Consider CPAP (mandatory CliniCall Consult).
  - → [PR09: Continuous Positive Airway Pressure](#)

### Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- [Salbutamol](#) and [ipratropium](#) via MDI with spacer.
  - Consider repeated salbutamol MDI therapy.
- Consider vascular access.

- → [D03: Vascular Access](#)
- Consider intravenous [magnesium sulfate](#).
- Consider intravenous or intramuscular [EPINEPHrine](#) for impending respiratory arrest. Epinephrine via intramuscular injection should be considered for a patient with SpO<sub>2</sub> <90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by metered dose inhalers
- Consider intubation as required. CliniCall must be consulted prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.
  - → [PR18: Anesthesia Induction](#)
  - → [PR23: Awake Intubation](#)

### Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

For obstructive lung pathologies:

- Consider intravenous [dexamethasone](#).
- Consider mechanical ventilation.
  - → [PR29: Mechanical Ventilation](#)
  - Adjust I:E ratio to avoid auto-PEEP.
    - Decrease T<sub>i</sub>.
    - Decrease respiratory rate (may require paralytics).
  - Accept high peak pressures.
  - Consider permissive hypercapnia.
  - Volume ventilation is generally preferred to maintain V<sub>E</sub>.

For restrictive lung pathologies:

- Consider underlying causes of restrictive lung and correct wherever possible (e.g., restrictive straps, circumferential burns, pneumo- or hemothorax, pulmonary edema, etc).
- Improve oxygenation:
  - Consider BiPAP as required.
  - Consider intubation as required.
- Consider mechanical ventilation:
  - → [PR29: Mechanical Ventilation](#)
  - Generally, begin on ACV with a target V<sub>t</sub> of 6-8 mL/kg (ARDSNET).
  - Increase PEEP/FiO<sub>2</sub> to target SpO<sub>2</sub> >90% and/or PaO<sub>2</sub> >60 mmHg.
  - For persistent hypoxemia consider:
    - Recruitment maneuver.
    - Open lung ventilation strategy.
    - Pressure control ventilation (inverse ratio).
  - Consider permissive hypercapnea.
  - [Consultation with EPOS is required.](#)
- Reduce oxygen demand:
  - Consider paralysis. [Requires EPOS consultation.](#)
  - Fever reduction.
- Arterial or venous blood gas analysis for therapy guidance.
- Consider a reduced cabin altitude if transporting by air.

## Evidence Based Practice

[Asthma](#)

[Respiratory Distress](#)

