

B03: Asthma and Bronchospasm

Mike Sugimoto

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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

- Nebulized beta-agonist therapy is the cornerstone of prehospital bronchospasm management; salbutamol is the medication of choice for an acute asthma attack. Addition of ipratropium has been demonstrated to improve bronchial flow and alleviate symptoms.
- In cases of impending respiratory failure or severe bronchospasm – defined as very poor to no air movement, an inability to speak, a tachypnea greater than 40/minute (or, paradoxically, a rapidly falling respiratory rate), or a falling level of consciousness – intramuscular epinephrine can be administered to provide rapid bronchodilation.
- Continuous positive airway pressure (CPAP) is available as an option to optimize oxygenation in patients who have already received bronchodilator therapy.

Additional Treatment Information

- **WARNING: CONSIDER THE RISK OF INFECTIOUS DISEASE EXPOSURE WHEN PERFORMING INTERVENTIONS THAT PRODUCE AEROSOLS. NEBULIZED MEDICATIONS SHOULD BE GIVEN WITH CAUTION TO PATIENTS WITH A FEVER AND A HISTORY OF A RESPIRATORY ILLNESS. USE APPROPRIATE PPE AS NECESSARY. APPLYING A SURGICAL MASK OVER A NEBULIZER IS NOT AN EFFECTIVE REVERSE ISOLATION TECHNIQUE.**
- **NEBULIZED MEDICATION THERAPY IS NOT AUTHORIZED DURING COVID.**
- 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 nebulized medication to run its course before making additional treatment decisions, unless the patient is deteriorating rapidly. In some cases, continuous nebulizer 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 sulphate, 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, accessory muscle use during inspiration, diaphoresis, the inability to speak in full sentences and the inability to lie supine, but 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 $\text{SpO}_2 \geq 94\%$ (caution: may not be achievable)
 - → [A07: Oxygen and Medication Administration](#)
- May assist patient with own MDIs

Emergency Medical Responder – All FR interventions, plus:

- Transport early
- Consider ACP intercept

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

- [Salbutamol](#) via nebulizer
- For severe disease progressing to imminent respiratory failure: consider intramuscular [EPINEPHrine](#) (mandatory CliniCall consult).
- Consider CPAP (mandatory CliniCall Consult)
 - → [PR09: Continuous Positive Airway Pressure](#)

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

- [Salbutamol](#) and [ipratropium](#) (combined) via nebulizer
 - Consider continuous salbutamol nebulizer therapy: salbutamol 5 mg with an additional 5 mL NS over 20+ minutes
- Consider vascular access
 - → [D03: Vascular Access](#)
- Consider intravenous [magnesium sulfate](#)
- Consider intravenous or intramuscular [EPINEPHrine](#) for impending respiratory arrest

- Consider intubation as required
 - → [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_i .
 - Decrease respiratory rate (may require paralytics).
 - Accept high peak pressures.
 - Consider permissive hypercapnia.
 - Volume ventilation is generally preferred to maintain V_E .

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_t of 6-8 mL/kg (ARDSNET).
 - Increase PEEP/FiO₂ to target SpO₂ > 90% and/or PaO₂ > 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](#)

