B03: Asthma and Bronchospasm

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Updated: March 28, 2024
Reviewed: December 18, 2023

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 limited wheeze. The bronchospasm can inhibit proper ventilation, provoking air trapping, and can also cause an increase in respiratory secretions, leading to mucus plugging and 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

- Bronchodilator therapy is the core treatment for bronchospasm, regardless of the underlying cause. The addition of ipratropium to bronchodilator therapy has been demonstrated to significantly improve clinical outcomes beyond the immediate term. Both salbutamol and ipratropium can be combined in the same nebulizer for co-administration purposes.
- In cases of impending respiratory failure or severe bronchospasm – defined as very poor to no air movement, an inability to speak, a tachypnea > 40/minute (or, paradoxically, a rapidly falling respiratory rate), or a falling level of consciousness – intramuscular epinephrine should 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.
- 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

- 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.
- 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 acute 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, decreasing level of consciousness, and declining respiratory rate.
- 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 and 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 convey 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

Refusal of care instructions and guidelines must be followed for patients who decline to be taken to hospital.

General Information

- Signs of acute severe asthma 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. 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

- Place the patient in a position of comfort, as permitted by clinical condition; in general, this will be a seated position with the patient leaning forward; limit patient movement
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Conduct ongoing assessment and gather collateral information, such as medications and identification documents
- May retrieve (but not administer) patient MDIs upon request
- Establish ingress and egress routes from the patient's location
- Communicate patient deterioration to follow-on responders

Emergency Medical Responder – All FR interventions, plus:

- Supplemental oxygen to maintain SpO_2 ≥ 94% (caution: may not be achievable)
  - → A07: Oxygen Administration
- ☐☐ **Requires completion of EMR scope expansion education:**
  - Salbutamol
  - MDI and spacer use is strongly recommended for patients with signs of influenza-like illness, or other infectious respiratory conditions
- Convey early
- Consider intercept with additional resources

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

- Salbutamol
  - MDI and spacer use is strongly recommended for patients with signs of influenza-like illness, or other infectious respiratory conditions
- ☐☐ **Requires completion of PCP scope expansion education or BCEHS Respiratory Assessment course:**

- Salbutamol with ipratropium (Both salbutamol and ipratropium can be combined in the same nebulizer for co-administration purposes. Note: ipratropium is a single dose administration, while salbutamol may be repeated).
- For severe disease progressing to imminent respiratory failure: consider intramuscular EPINEPHrine
  - Epinephrine via intramuscular injection should be considered for a patient with SpO_2 < 90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by MDIs
- CliniCall consultation recommended to discuss care planning options.
- Consider dexamethasone (Clinical consultation required prior to administration of dexamethasone)

- Consider CPAP
  - → PR09: Continuous Positive Airway Pressure

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

- Salbutamol and ipratropium
  - Consider repeated salbutamol therapy if limited/no improvement in bronchospasm symptoms
- 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 SpO2 < 90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol
- Consider intubation as required; CliniCall consultation required 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:

- Consider use of mechanical ventilation.
  - → PR29: Mechanical ventilation
    - Consider use of non-invasive ventilation
    - Consider invasive ventilation
    - Consider dynamic hyperinflation
      - < 3% of asthmatics develop dynamic hyperinflation. It is almost always due to breath stacking.
      - Consider decreasing breath rate to avoid breath stacking
      - Set PEEP 50-80% of the auto-PEEP
    - Consider I:E 1:3, 1:4
    - Consider reduced driving pressure < 15 cmH_2O
    - Consider permissive hypercapnia
    - Volume ventilation is generally preferred to maintain V_E typically 6-8 ml/kg
    - Consider ABG/VBG sampling to guide therapy
    - Consider radial arterial line placement
    - Consider femoral arterial line placement
- Consider a reduced cabin altitude if conveying by air. (Boyle's law)
- Anesthesia planning
  - Avoid morphine if possible (histamine release)
  - Consider Ketamine
  - Consider Propofol
  - Avoid Etomidate (increased airway resistance and adrenal dysfunction)
  - Consider paralytics
    - Succinlcholine

    - Rocuronium
    - Cisatracurium
- Glucocorticoids
    - Prednisone 40 mg
    - Methylprednisolone 60 mg or (0.5-1 mg/kg q6 hrs to a max of 60 mg/day pediatric)
    - Dexamethasone
- Consider use of empiric antimicrobials (azithromycin).
- Magnesium 2-4g or (25-75 mg/kg to a max of 2g pediatric)
- Call ETP prior to anesthetic gases. Consider anesthetic gas if unable to transport due to severe refractory bronchospasm. This is a temporizing measure until safe transport is possible. Must have an anesthetist capable of using the equipment and medication.
    - Consider sevoflurane or isoflurane. Avoid use of desflurane.
- Consider transport to ECMO center if not already planned.

Evidence Based Practice

Asthma

Supportive

- Anticholinergic
- Beta Agonist-MDI
- Beta Agonist-Nebulized
- Beta Agonist-Parenteral
- Epinephrine-Nebulized
- Hypertonic Saline-Nebulized
- Magnesium Sulfate-IV
- NiPPV
- Steroids-Inhaled
- Steroids-Oral
- Steroids-Parenteral
- Epinephrine- SQ
- Oxymetry Monitoring

Neutral

- Magnesium Sulfate-nebulized
- Steroids-IV
- High flow nasal canula
- Oxygen
- Epinephrine-IV
- Humidified oxygen
- Intubation

Against

Respiratory Distress NYD

Supportive

- NiPPV
- Intubation
- Oxymetry Monitoring
- Transfer of ECMO patients

Neutral

- High flow nasal canula
- Temperature Monitoring

Against

References

1. Fanta CH, et al. Acute exacerbations of asthma in adults: Home and office management. UpToDate. 2021.
2. Wenzel S. et al. Treatment of severe asthma in adolescents and adults. UpToDate. 2021.

Practice Updates

- 2023-09-29: updated EMR and PCP interventions to add salbutamol (EMR) and ipratropium, dexamethasone (PCP)
- 2023-12-18: removed COVID-related restrictions, added information about BCEHS Respiratory Assessment Course