B01: Airway Management

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Introduction

Airway management sits at the core of effective patient management in out-of-hospital care. In the vast majority of cases, it is the first clinical decision to be made. All patients require a structured airway assessment during their initial evaluation, even those who are not obviously in distress.

The decision to intervene is predicated on a combination of factors. Although the patient's clinical status is the most obvious of these, consideration must be given to crew resource management, training, scopes of practice, and conveyance times. The interplay between these factors can be complex and daunting regardless of the experience of individual paramedics and EMRs/FRs.

Airway intervention decisions can be broken down into three major categories, each of which carries with it a particular level of urgency. The first question revolves around whether there is a need to obtain or maintain an airway – this suggests there is an immediate problem that requires correction, whether that takes the form of a jaw thrust or a pharyngeal airway. The second question considers whether or not there is a problem with oxygenation or ventilation. These types of problems often require rapid intervention, either with supplemental oxygen, a bag-valve mask, or through the use of medications. The third question asks paramedics and EMRs/FRs to consider what the anticipated clinical course is; if patient deterioration is expected, it may be advantageous to intervene earlier, when treatments are more likely to be effective and easier to implement, as opposed to later.

Essentials

- The goal of all airway management is effective and safe **oxygenation** and **ventilation**, regardless of modality or intervention strategy. Effective ventilation depends on sufficient tidal volume and respiratory rate. Effective oxygenation depends on the fraction of inspired oxygen, the capacity for gas to diffuse across the alveolar membrane, the ability (and availability) of haemoglobin to transport oxygen throughout the body, and the propensity of oxygen to diffuse into tissues.
- Because end-organ and tissue perfusion depends on the ability of the body to transport oxygen in the blood, paramedics and EMRs must ensure that patients have a blood pressure sufficient to support life. Volume replacement may be required before airway interventions can take place effectively.
- A thorough and comprehensive respiratory assessment must be performed on all patients. Assessments of airway patency and adequacy of respiration should be performed concurrently with other elements of the primary survey.
- Intervention strategies should progress from simple strategies to more complex approaches and must be based on an understanding of the patient's needs rather than a technical imperative.
- If unable to ventilate despite basic airway maneuvers, consider the presence of an obstructed airway and begin chest compressions.

Additional Treatment Information

Treatments:

- The jaw thrust is the most effective manual maneuver to open an airway when the patient's own muscle tone is lost. In using a jaw thrust, the tongue and epiglottis are lifted away from the posterior oropharynx, maximizing the available space. Pharyngeal airways provide additional assistance at resolving these functional airway obstructions, though a jaw thrust will still need to be maintained even with the adjunct in place to ensure the best possible airway opening. There is no evidence to suggest that a nasopharyngeal airway is better or worse than an oropharyngeal airway; device selection should be based on the presence or absence of gag and airway reflexes.
- Effective bag-valve mask ventilation is a difficult skill to learn and maintain. Optimal bag-valve mask ventilation, in most cases, requires two operators: one to maintain a mask seal and provide a jaw thrust, the other to operate the bag. Lift the patient's face into the mask while providing ventilations. Exposure of the patient's thorax to visualize chest rise and fall is essential; deliver only enough volume to see chest rise and avoid high

tidal volumes.

- Critically ill patients can be supported by use of a nasal cannula with a maximum flow rate of 5 L/min in addition to a bag-valve mask (NODESAT or high-flow nasal cannula technique). The inclusion of a PEEP valve in this scenario provides for maximal oxygen delivery in the out-of-hospital environment and allows paramedics to assist ventilations if it becomes necessary.
- When applying CPAP, watch oxygen saturations carefully. Be prepared for a transient fall in oxygen saturation: this is the result of a change in the FiO_2 from a face mask to the CPAP device. Give the device time to work properly before making adjustments. Additional oxygen may become necessary if saturations remain low.

General Information

- A functional airway obstruction occurs when muscle tone in the upper airway is lost and structures collapse under their own weight. The culprits are generally the tongue against the soft palate and the posterior oropharynx, as well as the epiglottis. Functional airway obstructions should be suspected in all patients with an altered level of consciousness and may present as snoring or stertorous respirations, asynchronous chest and abdominal movements, or irregular breathing patterns.
- Be aware of the development of pathological airway obstructions, from infectious diseases, trauma, medication reactions, or anaphylaxis. Options for managing pathological airway obstructions in the out-of-hospital environment are limited - epinephrine (and cricothyrotomy by advanced providers) is generally the only effective choice.
- Carefully consider the interplay between ventilation and oxygenation. Ventilation is the mass movement of gas between the lungs and the atmosphere. Oxygenation is the diffusion of oxygen across the alveolar membrane, the binding of oxygen with hemoglobin for transport to other body tissues, and the subsequent release of that oxygen once it reaches its destination. Both are required to support life, and problems with one can affect the other. Paramedics and EMRs/FRs should remember that they are distinct processes.
- Patients with ventilation deficits do not respond solely to supplemental oxygen. They may require bronchodilation (either with salbutamol or epinephrine, depending on the clinical scenario) or positive pressure ventilation by bag-valve mask. An inadequate respiratory rate, with or without a concurrent fall in tidal volume, requires immediate intervention.
- Hypoxia is the sign of an oxygenation problem. These patients may have adequate ventilation, but are unable to diffuse oxygen across their alveolar membranes (or transport oxygen in the blood). Supplemental oxygen is required in these cases.
- Continuous positive airway pressure (CPAP) masks are not ventilation devices. They are designed to improve the diffusion of oxygen across the alveolar membrane: they will not help patients who do not have an adequate respiratory rate or tidal volume. The specific FiO_2 produced by a CPAP mask is unknown due to the entrainment of ambient air required to generate the positive pressure – when using CPAP, carefully monitor oxygen saturations and adjust flow rates as required. It may be necessary to add oxygen via nasal cannula in critically ill patients.

Interventions

First Responder

- Assess patient and position for optimal access based on clinical need
- Functional airway obstruction present:
  - Perform jaw thrust to open airway
  - Attempt placement of oropharyngeal airway
- Provide optimized bag-valve mask ventilation as necessary
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Monitor and providing ongoing care until arrival of additional resources

Emergency Medical Responder – All FR interventions, plus:

- Functional airway obstruction present:
  - Airway reflexes intact: measure and insert a lubricated nasopharyngeal airway
  - → PR07: Nasopharyngeal Airway

- Airway reflexes absent: measure and insert oropharyngeal airway
- Provide supplemental oxygen as required to maintain $SpO_2 \geq 94\%$
  - → A07: Oxygen Administration
- Consider higher level of care intercept where available

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

- Supraglottic airway devices may be used to support oxygenation and ventilation in a staged approach, following confirmation of the ability to ventilate the patient with a bag-valve mask and pharyngeal airway
  - → PR08: Supraglottic Airway
- In non-cardiac arrest situations:
  - If SBP ≥ 90 mmHg and unable to attain $SpO_2 \geq 94\%$, consider use of PEEP
  - → PR10: Positive End Expiratory Pressure
- Consider use of CPAP
  - → PR09: Continuous Positive Airway Pressure

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

- May consider supraglottic airway device with a viral filter for any obtunded patient
  - → PR08: Supraglottic Airway
- Options for invasive airway intervention in conscious patients:
  - All patients not in cardiac arrest being intubated should receive sufficient volume resuscitation prior to intubation - 500 mL NS or as clinically appropriate
  - Consider awake intubation
  - CliniCall consultation required prior to attempting intubation for patients with perfusing rhythms.
    - → PR23: Awake Intubation
- Consider induction for intubation
  - CliniCall consultation required prior to attempting intubation for patients with perfusing rhythms.
  - → PR18: Anesthesia Induction
  - → PR15: Tracheal Tube Introducer
- Following 2 failed attempts at intubation, attempt placement of supraglottic airway device with a viral filter while preparing for surgical access
  - → PR22: Surgical Airways

NEW: Prospective consultation with CliniCall is required prior to intubating patients with a perfusing rhythm or a palpable pulse. When a prospective consultation is not possible due to clinical or technical factors, a retrospective consultation must still take place as soon as practicable to support paramedic clinical decision-making and airway quality assurance.

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

- May consider rapid sequence intubation as required
  - → PR47: Critical Care Anesthesia Planning

Evidence Based Practice

Intubation

Supportive

- Bougie
- Laryngeal Manipulation
- Oxymetry Monitoring

- Securing tube

Neutral

- Direct Laryngoscopy (No airway reflexes)
- Direct Laryngoscopy (with airway reflexes)
- ETI via a SGA device
- Lighted Stylet
- NO DESAT/Nasal apneic oxygenation
- Optical (non-video) Visualization (e.g. Airtraq)
- Video Visualization (e.g. Glidescope)
- Digital Intubation
- Nasotracheal intubation

Against

- Cricoid Pressure

Alternative Rescue Airway Management

Supportive

- BVM
- Laryngeal Tube (without AW reflexes)
- I-Gel
- Laryngeal Tube (with AW reflexes)
- Surgical Cricothyrotomy
- Bougie-assisted Cricothyrotomy
- Pressure manometer

Neutral

- NPA
- OPA
- Pharyngeal Tracheal Lumen (PTL)
- LMA (with AW reflexes)

Against

- Combitube (without AW reflexes)
- LMA (without AW reflexes)
- Percutaneous Cricothyrotomy
- Combitube (with AW reflexes)

Medication for Airway Management

Supportive

- RSI (CCT)
- Sedation
- DSI (CCT)

Neutral

- Topical anaesthetic
- RSA
- Sedation (CCT)

Against

- Rapid Sequence Induction

Airway Confirmation

Supportive

- Quantitative Capnography (with circulation)
- EDD
- Qualitative Capnography (with circulation)

Neutral

- POCUS
- Oxymetry Monitoring
- Qualitative Capnography (no circulation)
- Quantitative Capnography (no circulation)

Against

References

1. Kovacs, et al. Airway Management in Emergencies: The Infinity Edition. 2020. [Link]

Practice Updates

- 2023-12-18: Removed COVID-related restrictions.

B02: Airway Obstruction

Mike Sugimoto

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Introduction

Airway obstructions are relatively rare, yet life-threatening conditions that require immediate recognition and intervention to avert disaster. Whether they are complete or partial, airway obstructions can result from foreign bodies entering the trachea, pathological conditions that produce a narrowing of the upper airway, or trauma to the mouth, face, head, or neck. The core treatment of an airway obstruction involves attempting to obtain or maintain a patent airway while at the same time identifying and reversing the underlying clinical problem where possible.

This guideline focuses on foreign body airway obstructions (FBAO). Paramedics and EMRs/FRs should refer to other guidelines for the management of croup, epiglottitis, or anaphylaxis as necessary.

- → B04: Croup and Epiglottitis (Stridor)
- → E09: Anaphylaxis

Essentials

- Unconscious patients should have their breathing and circulation assessed concurrently. If the patient is found to be pulseless, immediately begin chest compressions and attach a defibrillator – do not attempt to ventilate these patients prior to beginning CPR. In cardiac arrest, the lack of a patent airway is significantly less important than the need to establish circulation.
- Chest compressions are the core management of a complete FBAO. If in doubt as to the ability to ventilate an unconscious patient, begin chest compressions. The ratio of chest compressions to ventilation attempts is unimportant, but the sequence of actions is: visualize the oropharynx; attempt to remove any foreign body that is seen; attempt to ventilate; then resume chest compressions.
- Consider the use of patient positioning while attempting to manage partial airway obstructions, especially for patients with facial or oral trauma. 'Sit up and lean forward' can be a very useful technique when combined with aggressive suction.
- Partial airway obstructions often require only supportive care and encouragement, although paramedics and EMRs/FRs must be prepared to intervene if the situation deteriorates. However, patients with a partial airway obstruction and signs of poor air exchange – stridor, weak cough, and/or cyanosis – must be treated as a complete airway obstruction.
- Rapid conveyance, with intercept of additional resources and hospital notification, is indicated for persistent airway obstruction, whether partial or complete.

Additional Treatment Information

- Abdominal or chest thrusts are indicated for complete airway obstructions in conscious patients. Use chest thrusts in pregnant or obese patients; these can be performed with the patient supine and are identical to chest compressions in CPR. No evidence exists to support the superiority of chest thrusts over abdominal thrusts (or vice versa) in any population and controversy exists among resuscitation councils as to the effectiveness of back blows in adult populations.
- Back blows may be effective in children under one year of age and should be alternated with chest thrusts as necessary. Children over one year old should be managed with abdominal thrusts.
- When confronted with a patient who cannot be ventilated, advanced providers should begin chest compressions or abdominal thrusts while preparing for both direct laryngoscopy and a surgical airway. Under laryngoscopic visualization, foreign bodies may be removed using Magill forceps – do not attempt to blindly insert forceps into the airway. High vacuum suction, coupled with the Ducanto catheter, may help relieve some airway obstructions.
- Advanced providers should have a low threshold to perform a surgical airway in patients who cannot be ventilated effectively and where the obstruction cannot be visualized and readily removed. The same applies in cases of pathological airway obstruction that cannot be immediately reversed.

- Open cricothyrotomy is contraindicated in children under the age of 12. In these patients, needle cricothyrotomy can be performed instead.

Referral Information

- Paramedics and EMRs/FRs should be aware that abdominal thrusts have the potential to cause significant trauma, including lacerations of internal organs. Patients who received abdominal thrusts, whether from health care providers or lay rescuers, should be conveyed for observation and evaluation.
- Pathological airway obstructions must be conveyed for evaluation and treatment.

General Information

- In adults, eating is the most common precipitating event of a FBAO, with meat being the most likely culprit. Children, by contrast, are more prone to have non-food foreign bodies.
- Submersion or drowning victims do not, as a general rule, experience airway obstructions. The use of abdominal thrusts is not recommended for these patients; the focus should be on the initiation of chest compressions as early as possible for those who are unresponsive and pulseless, with effective bag-valve mask ventilations to address the underlying hypoxia. Patients who are conscious and breathing spontaneously may benefit from CPAP use.

Interventions

First Responder

- Position patient for optimal intervention
- For partial airway obstruction: encourage patient to cough
- For complete airway obstruction **in conscious patients**: begin abdominal thrusts
  - In children under 1 year of age, administer alternating sequences of 5 back blows and 5 chest compressions until the obstruction clears or the patient becomes unconscious
- For complete airway obstruction **in unconscious patients**: begin chest compressions
  - → PR06: High Performance CPR
- Visualize oropharynx prior to every attempt at ventilation and remove foreign bodies if seen; do not attempt blind finger sweeps

Emergency Medical Responder – All FR interventions, plus:

- Initiate conveyance with notification
- Consider intercept with additional resources

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

- Consider video or direct laryngoscopy for FBAO removal using Magill forceps, with or without suction
- Consider surgical airway
  - → PR22: Surgical Airways

Evidence Based Practice

Foreign Body Obstruction(Complete/Partial)

Supportive

- Abdominal Thrusts
- Direct Laryngoscopy and Magill forceps
- Oxygen

Neutral

Against

References

1. Panchal AR, et al. Part 3: Adult basic and advanced life support: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. 2020. [Link]
2. Topjian, AA, et al. Part 4: Pediatric basic and advanced life support: 2020 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. 2020. [Link]

Practice Updates

- 2023-12-18: Removed COVID-related restrictions.

B03: Asthma and Bronchospasm

Mike Sugimoto

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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
- ClinCall 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; ClinCall 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

B04: Croup and Epiglottitis

Mike Sugimoto

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Introduction

Croup and epiglottitis are infectious inflammations of the upper airway. Although adults and children can develop swelling in their upper airways as a result of illness, this inflammation is significantly more pronounced in children because of their inherently smaller airways. Both croup and epiglottitis are serious medical emergencies that require early identification and intervention.

Essentials

- Epiglottitis in children is typically of abrupt onset and is associated with the 'three Ds': drooling; dysphagia; and distressed breathing. Coughing is rare. Classically, children adopt a tripod position and are reluctant to lie down. Adults may complain only of a severe sore throat, fever, and muffled voice. **Do not** attempt to visualize the oropharynx in these cases, unless necessary to control the airway in severely decompensated patients. Because out-of-hospital treatment options are so limited, urgent conveyance to an appropriate facility is of high importance. Do not place these patients in a supine position as doing so may cause respiratory arrest.
- The onset of croup is slower and is generally associated with a prodromal history of viral symptoms (e.g.,fever, cough, nasal congestion, etc). The barking or seal-like cough, with or without inspiratory stridor, is the hallmark of croup. Treatment of croup should be initiated regardless of the degree of stridor, as the inflammation can extend throughout the entire respiratory tract (a condition known as laryngotracheobronchitis).
- An effective treatment for croup in the out-of-hospital setting is nebulized epinephrine. Children who exhibit stridor while at rest should be treated with nebulized epinephrine regardless of whether they demonstrate retractions, agitation, lethargy, or cyanosis. Nebulized epinephrine is not indicated for epiglottitis. Westley Croup Score
- Croup is most prevalent in children between six months and three years of age and is uncommon in those over six years old.
- Paramedics and EMRs/FRs should be aware of the possibility of other causes of upper airway obstruction, including foreign bodies, trauma, and inhalation injuries.

Additional Treatment Information

- Because the inflammation of croup can extend throughout the respiratory tract, compromising ventilation and oxygenation, paramedics and EMRs/FRs must be aware of the potential for sudden deterioration. An early warning sign of deterioration is a fall in oxygen saturation, though supplemental oxygen can artificially prop up SpO_2 limiting the usefulness of this tool. Patients with croup should not be kept on oxygen except as necessary to provide nebulized epinephrine therapy and should be monitored closely for other signs of increasing respiratory distress.
- Although cold or hot humid air can sometimes provide a temporary relief of symptoms for croup, these should not be considered definitive treatments.

General Information

- Epiglottitis is a cellulitis of the epiglottis and surrounding structures caused either by a bacteremia or direct invasion by pathogenic organisms. Bacteria, viruses, and fungi have all been implicated in infectious epiglottitis, though similar symptoms can be seen in cases of trauma, inhalational injury, and airway burns. Although the disease was once commonly seen in children (again, because of the significant differences in airway size), epiglottitis has become comparatively rare due to routine immunization against *Haemophilus influenzae* type B (Hib) as part of routine childhood vaccinations. Risk factors for the development of epiglottitis, in both children and adults, include non-compliance with recommended immunization schedules and immune deficiencies.
- As a general rule, croup is caused by a viral infection and thus, often presents with a history of viral symptoms (e.g., nasal congestion, cough, sore throat, fever). It is important to remember that although the primary

manifestation of croup is upper airway stridor, the entirety of the respiratory tract can be inflamed (laryngotracheobronchitis).

- In both croup and epiglottitis, the tissues of the upper airway can act as a one-way valve, allowing exhalation while restricting inspiration. The prolonged inspiratory time can be a helpful tool to differentiate between upper and lower airway inflammation. If mechanical ventilation becomes necessary, higher airway pressures may be necessary to overcome this phenomenon.

Interventions

First Responder

- Provide reassurance and a calming environment
- Keep the patient warm and protect from further heat loss
- Place the patient in a position of comfort, as permitted by clinical condition. In general, limit patient movement
- Provide supplemental oxygen where indicated
  - → A07: Oxygen Administration
- Conduct ongoing assessment and gather collateral information, such as medications and identification documents
- Establish ingress and egress routes from the patient's location
- Communicate patient deterioration to follow-on responders

Emergency Medical Responder – All FR interventions, plus:

- Monitor oxygen saturation and provide supplemental oxygen to maintain an SpO_2 ≥ 94%
  - → A07: Oxygen Administration
- Convey early
- Consider intercept with additional resources

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

- For croup: EPINEPHrine via nebulizer over 15 minutes
  - ClinCall consultation recommended to discuss care planning options.
  - □□ **Requires completion of PCP scope expansion education:**
    - Consider dexamethasone PO, IM IV, IO for significant stridor without marked improvement from inhaled EPINEPHrine
      - ClinCall consultation required prior to administration of dexamethasone

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

- Consider need for invasive airway management in severely decompensated patients. Intubation should be reserved for patients in extremis; difficulty should be predicted in these cases.
  - ClinCall consultation required prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.
- Consider need for antipyresis
  - Acetaminophen

Evidence Based Practice

Pediatric Stridor

Supportive

- Epinephrine-Nebulized
- Oxygen-Humidified

- Steroids-Oral

Neutral

Against

Practice Updates

- 2023-09-29: added dexamethasone to PCP interventions
- 2023-12-19: removed COVID-related restrictions

B05: Chronic Obstructive Pulmonary Disease

Christine Hudson and Mike Sugimoto

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Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive, degenerative structural lung disorder that results in impaired ventilation. It is the result of persistent lung irritation from any of a number causes, including but not limited to, smoking, chemical exposure, and repeated infections. It includes progressive lung diseases such as emphysema. Although COPD cannot be cured, it can be managed. Patients with COPD often live with some degree of respiratory distress and frequently seek help during exacerbations of their disease, which are often prompted by respiratory tract infections.

Essentials

- COPD is primarily a disease of ventilation. Treatment should be directed towards improving overall airflow with bronchodilators and steroids.
- Critical hypercarbia can develop in patients with COPD despite high respiratory rates and apparently effective tidal volumes due to changes in the alveoli and pulmonary circulation. Monitor patients closely for signs of impending respiratory failure (a falling level of consciousness, a decreasing respiratory rate, decreasing tidal volumes) and intervene early if necessary.
- Oxygen therapy should be titrated based on what is typical for the patient, where this information is readily available. Although oxygen should never be withheld from patients who are acutely short of breath, its administration should be a considered act with due care and attention. Patients living with COPD are often very aware of their oxygen saturation when not in crisis; they, or their caregivers, can be used as a resource to guide oxygen therapy.
- When patients report a history suggestive of respiratory infections, paramedics and EMRs/FRs must use appropriate personal protective equipment and should avoid all aerosol generating procedures until protective measures are in place.
- Recognize that treatment options for COPD exacerbations in the out-of-hospital environment are limited. Extrication and conveyance should be accomplished as soon as practical and safe. Do not exert patients during movement.

Referral Information

Patients with COPD are at significant risk for recurrent hospital admissions due to exacerbation of their disease.

Community paramedics should refer to the CP COPD guidelines for additional management information.

General Information

- Patients with COPD often have comprehensive management plans prescribed by their care team. These plans reflect an individual's condition and describe a series of actions to be taken based on symptoms. Compliance with the action plan, and response to treatment, should form part of any investigation into an exacerbation of COPD.
- Complete relief of symptoms, including audible wheezes, is frequently not possible. Although paramedics and EMRs/FRs should be aggressive in attempting to relieve dyspnea, therapeutic end points should be set with reference to the patient's normal condition.
- In the absence of patient-specific information, paramedics and EMRs/FRs should consider observable signs that describe the degree of distress. The ratio of inspiratory time to expiratory time is an important clinical clue to the effectiveness of therapy, as is the tidal volume with each breath.
- Paramedics and EMRs/FRs should consider the possibility of concurrent disease processes and seek evidence to include or exclude other diagnoses.
- If a patient continues to deteriorate despite aggressive therapy, consider the possibility of barotrauma and pneumothorax.

Interventions

First Responder

- Minimize patient activity and do not exert patients during movement
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Place patient in position of greatest comfort and easiest breathing (generally sitting up)
- Assist patient with retrieval of own inhalers if prescribed
- Begin positive pressure ventilation using bag-valve masks if respiratory failure develops

Emergency Medical Responder – All FR interventions, plus:

- Titrate supplemental oxygen to SpO_2 88-92%
  - → 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
- □□ **Requires completion of PCP scope expansion education:**
  - Salbutamol and ipratropium
    - MDI and spacer use is strongly recommended for patients with signs of influenza-like illness, or other infectious respiratory conditions
  - Consider dexamethasone (ClinCall 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
- Apply a staged approach to airway and breathing interventions as required
- ClinCall consultation required prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.

Community Paramedic (CP) Interventions

- → CP 4.9: Chronic Obstructive Pulmonary Disease

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
  - set PEEP 50-80% of the auto-PEEP
  - Consider decreasing breath rate to avoid breath stacking
- Consider I:E 1:3, 1:4
- Consider reduced driving pressure < 15 cmH_2O
- Consider permissive hypercapnia
- Consider ABG/VBG sampling for guidance of therapy.

- Consider radial arterial line placement.
- Consider femoral arterial line placement
- Anesthesia planning
  - Avoid morphine if possible (histamine release)
  - Consider Ketamine
  - Consider Propofol
  - Avoid Etomidate (increased airway resistance and adrenal dysfunction)
  - Consider paralytics
    - Succinylcholine
    - Rocuronium
    - Cisatracurium
- Glucocorticoids
  - Prednisone 40 mg
  - Methylprednisolone 60 mg
- Antimicrobial
  - antibiotic
  - antiviral
- Magnesium 2-4g
- Call ETP prior to anesthetic gas administration.
- 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
  - Avoid Desflurane

Evidence Based Practice

COPD

Supportive

- Beta Agonist-Nebulized
- Beta Agonist-Parenteral
- NiPPV
- Oxygen-titrated
- Beta Agonist-MDI
- Oxymetry Monitoring

Neutral

- Anticholinergic
- High flow nasal canula
- Humidified oxygen
- Intubation

Against

- Oxygen-high flow

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Practice Updates

- 2023-09-29: added salbutamol to EMR interventions; added ipratropium, dexamethasone to PCP interventions
- 2023-12-19: removed COVID-related restrictions

B06: Pulmonary Embolism

Mike Sugimoto

Updated: September 02, 2021
Reviewed:

Introduction

A pulmonary embolism occurs when the pulmonary arterial circulation becomes blocked by material originating elsewhere in the body, either fat, air, or a thrombus. The occlusion causes a variety of symptoms resulting from a combination of poor pulmonary circulation, poor gas exchange and oxygen transport, and right ventricular strain; these can include chest pain, shortness of breath, cough, hypotension, and syncope.

Essentials

- For hemodynamically normal and stable patients with signs and symptoms of a pulmonary embolism, no specific therapies are required beyond monitoring, supplemental oxygen as required, and conveyance to hospital.
- Hemodynamically compromised or otherwise unstable patients require a similar approach, but consideration must be made to the logistics of conveyance and the provision of en route care.
- When conveying a hemodynamically compromised patient with a suspected pulmonary embolism, paramedics and EMRs should plan their conveyance strategy with regards to the need for effective chest compressions should the patient progress to cardiac arrest. Though this may require additional resources, paramedics and EMRs should not wait before initiating conveyance – consider intercept with additional resources en route.
- Patients with a strong suggestion of a pulmonary embolism, and who are in cardiac arrest, should be conveyed as soon as possible with an emphasis on effective chest compressions and early notification to the receiving facility.
- Under most circumstances, paramedics and EMRs/FRs should not cease resuscitation of patients with a suspected pulmonary embolism until contact with CliniCall has been made.

General Information

The severity of symptoms caused by a pulmonary embolism can be extremely variable. Patients can be asymptomatic or near death. Emboli can develop acutely or over a longer term. There can be a clear precipitating event or the origin of the thrombus can be uncertain. As a result, the diagnosis of a pulmonary embolism can be very complex, often subtle, and remains – even with imaging and laboratory tests – one of the most difficult diagnoses in medicine.

In the out-of-hospital environment, the provisional diagnosis of a pulmonary embolism should be reserved for those cases that unequivocally point towards that conclusion – either because of significant history findings, or as a result of clinical presentation. Suspicion will be vastly more common than certainty. Clinical history findings that should prompt the consideration of a pulmonary embolism include:

- Malignancy
- Pregnancy or other hormonal change (e.g., birth control)
- Recent stroke
- Recent hospitalization or restriction of movement
- Recent traumatic spinal cord injury
- Recent joint replacement or other surgical procedure
- Known thrombophilia
- Known venous thromboembolism

Common signs and symptoms of pulmonary embolism can include:

- Sudden onset shortness of breath at rest or on exertion
- Pleuritic chest pain
- Cough
- Orthopnea
- Calf or thigh pain or swelling

- Wheezing
- Syncope

Patients with pulmonary embolisms may present with significant hemodynamic compromise that can progress to cardiac arrest. The possibility of a pulmonary embolism should be entertained when other causes of hemodynamic instability do not adequately account for the patient's presentation. Suspicion should be further raised when the symptoms develop suddenly and without warning.

There is no specific out-of-hospital treatment for a pulmonary embolism. Care is primarily supportive, aimed at optimizing oxygenation and ventilation while supporting blood pressure and ensuring rapid conveyance to hospital.

If a patient with a suspected pulmonary embolism suffers a cardiac arrest, early consultation with both CliniCall and the receiving hospital should be made to discuss a resuscitation and potential reperfusion strategy. Thrombolysis is an option for patients whose cardiac arrests are likely due to embolic events; conveyance should be prioritized, with a focus on ensuring high-quality CPR during patient movement to the maximum extent possible.

Interventions

First Responder

- Provide airway management as required
  - → B01: Airway Management
- In cardiac arrest: begin chest compressions
  - → PR06: High Performance CPR
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen as required to maintain an $SpO_2 \geq 94\%$ (caution: may not be achievable)
  - → A07: Oxygen Administration
- Provide rapid conveyance
- Consider intercept with additional resources

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

- Consider supraglottic airway for decreased levels of consciousness when unable to ventilate using pharyngeal airways
  - → PR08: Supraglottic Airways

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

- Intubation as required; avoid intubation strategies that depress blood pressure
  - → PR18: Anesthesia Induction
  - → PR23: Awake Intubation

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

- Mechanical ventilation
- RV failure can be exacerbated with induction. Follow right heart induction strategies.
  - Avoid high Pplat.
  - Avoid high PEEP
- Hemodynamic support
  - Ultrasound guided (IVCDI, right heart strain, McConnel's sign)
  - IV fluid (potentially harmful in patients with right heart failure)
    - With the right heart failure do not decrease preload.
    - The right ventricle can not compensate with an increase in contractility. It compensates with heart rate due to interventricular coupling. Therefore, allow for tachycardia.
  - Norepinephrine

- Phenylephrine
- Epinephrine and Dopamine may exacerbate tachycardia predisposing one to dysrhythmias.

- Call ETP prior to thrombolytics or pulmonary vasodilators. Consider inotropic support with possible pulmonary vasodilator effects.
  - Dobutamine
  - Milrinone
- Anticoagulation consider Wells scoring
  - Heparin
  - Thrombolysis (tPA)

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