

A07: Oxygen and Medication Administration

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Introduction

The administration of oxygen and medications is a fundamental component of paramedic practice. Although routine, both require thoughtful consideration: paramedics must have a comprehensive understanding of a patient's clinical indications for both oxygen and medication administration, and must adhere to current best practices while engaged in any therapeutic activity.

Essentials

- The administration of oxygen should be based on an assessment of overall patient need rather than a formulaic application. Respiratory effort, mentation, oxygen saturation, blood pressure, and clinical scenario all play a role in determining whether oxygen should be given.
- In general, paramedics should use the lowest oxygen flow rate possible to achieve an SpO₂ of 90%. This may not be possible for patients who have pre-existing conditions, such as chronic obstructive pulmonary disease; in these cases, titrate to maintain the patient's normal oxygen saturation.
- Do not routinely administer oxygen to patients with normal oxygen saturations where a clearly defined clinical need is lacking.
- Medication safety is the responsibility of all paramedics. Follow safe medication handling procedures at all times.

Additional Treatment Information

- The administration of oxygen should follow a staged approach, where simple, non-invasive options are tried before more aggressive (or invasive) options are explored. Nasal cannula are preferable to face masks, while face masks are preferable to bag-valve masks.
- Recall that adequate oxygenation depends not only on the fraction of inspired oxygen but also on the ability of the patient to ventilate, diffuse gases in the alveoli, and transport oxygen in the blood. Patients require sufficient hemoglobin and an adequate blood pressure to oxygenate effectively.
 - → [B01: Airway Management](#)
 - → [D01: Shock](#)
 - → [D02: Bleeding](#)
- Do not withhold oxygen from patients who are significantly short of breath in order to obtain a room air oxygen saturation. Treat symptomatically to start, and then titrate to bring the oxygen saturation into a normal range.
- In the absence of accurate pulse oximetry in a patient with shortness of breath, administer oxygen until symptoms resolve, or accurate measurements can be obtained.

Principles of Medication Safety and Administration

- Medication errors are the leading cause of patient safety incidents in health care, and are preventable through close compliance with a set of best practices for drawing up, administering, and storing pharmaceutical products. The "six rights" encapsulate the primary basis for these practices:
 - Right patient: does the patient meet the indications for the medication based on current clinical practice guidelines?
 - Right medication: is the correct medication being prepared, and has the identity of the medication been checked at each step of the preparation process and prior to administration?
 - Right dose: have dosage calculations been verified and confirmed?
 - Right time: is this the correct time to administer the medication based on the treatment plan that has been developed?
 - Right route: is the proposed route of administration correct for both the medication and the clinical indication?
 - Right documentation: has the administration of the medication been entered into the ePCR?

- Failure to adhere to these practices can result in serious and potentially fatal adverse events. Paramedics must be particularly vigilant with respect to medication identity, dosing strategies, and routes of administration. Errors in medication administration must be documented on the ePCR and reported through the Patient Safety Learning System.
- Visually inspect all medications prior to administration, including the label. Do not administer medication that is cloudy, beyond its expiry date, or where the appropriate diluent is not available.
- If a medication is drawn into a syringe (or otherwise removed from its packaging), paramedics must ensure that the syringe is clearly and unambiguously labeled with the medication and its concentration. Labels for naloxone, dimenhydrinate, diphenhydramine, MIDAZOLAM, EPINEPHRINE, morphine, adenosine, atropine, amiodarone, rocuronium, fentanyl, succinylcholine, phenylephrine, magnesium sulfate, ketamine, lidocaine, and propofol are available and must be used. Blank labels can be filled out and used in those instances where a pre-printed label is not available.
- When preparing a medication for infusion, paramedics must affix a label to the bag of fluid indicating the name of the medication as well as the final concentration prior to connecting the solution to an intravenous line.
- Paramedics must confirm the patient's allergies prior to administering any medication.
- **EPINEPHRINE HOLDS UNIQUE RISKS FOR PATIENTS. MEDICATION ERRORS INVOLVING EPINEPHRINE CAN BE FATAL. EPINEPHRINE VIALS MUST BE SEGREGATED FROM OTHER MEDICATIONS AND STORED IN SPECIALLY MARKED CONTAINERS IN MEDICAL KITS AND AMBULANCE CABINETS.**
- Do not remove medication from outer packaging prior to use.
- Do not use preloaded saline syringes to dilute medications, and do not store diluted medications in a preloaded saline syringe. These syringes are intended for flushing intravenous lines only.
- Never give the contents of a syringe that is not labeled unless it was immediately drawn from an ampoule or vial.
- Reconciliation of controlled and targeted substances must be completed in accordance with BCEHS policy.

General Information

- Early, aggressive oxygen administration may be beneficial to critically ill and hemodynamically unstable patients, such as those in cardiac arrest or who require resuscitation. In these cases, paramedics should aim to achieve an oxygen saturation of 100%. Once the patient is stabilized, oxygen can then be titrated down to an SpO₂ of ≥90%.
- Adverse events from hyper-oxygenation do occur, and sustained hyperoxia has been linked to increases in morbidity and mortality.
- Pulse oximetry may be particularly unreliable in patients with peripheral vascular disease, severe asthma, severe anemia, cold extremities or peripherally hypoperfused, severe hypotension and carbon monoxide poisoning. In the absence of reliable oximetry data, in critical illness, oxygen should be administered.
- Oxygen administration via a BVM should provide a tight seal with the BVM using a 2-person technique where possible.

Interventions

First Responder

- Intervene early. Do not wait for signs or symptoms of obvious hypoxia to develop, but act on the potential or suspicion of respiratory insufficiency.
- Ventilation is as important as oxygenation. Do not withhold BVM ventilations to patients who require ventilatory support. Maintain a tight seal with the BVM using a 2-person technique where possible.
- Patients with mild to moderate shortness of breath:
 - Consider nasal cannula at a maximum flow rate of 5 L/min.
- Patients with severe shortness of breath or suspicion of critical illness (e.g., anaphylaxis, seizures, shock, traumatic injuries)
 - Consider non-rebreather face mask (NRFM) at 10-15 L/min.
 - A nasal cannula may be placed under an NRB, CPAP or BVM when flow rates above 5 L/min are required.
 - Assist ventilations with BVM where required.

Emergency Medical Responder – All FR interventions, plus:

- Mild-Moderate Hypoxemia (SpO₂ 85-91%)
 - Initial dose of 2-5 L/min via nasal cannula. Consider face mask 5-10 L/min.
- Severe hypoxemia (SpO₂ < 85%) or critical illness (e.g., anaphylaxis, seizure, septic shock, traumatic brain injury)
 - Initial dose of 10-15 L/min via non-rebreather face mask (NRFM). Consider BVM ventilation. Once stable, titrate oxygenation to 92-95%.
 - → [E09: Anaphylaxis](#)
 - → [F02: Seizure](#)
 - → [H03: Head Trauma](#)
 - → [K02: Sepsis](#)
- Chronic hypoxemia (COPD, cystic fibrosis, obesity, neuromuscular disorders)
 - Titrate SPO₂ 88-92%. High-flow oxygen may be harmful in these patients. Do not neglect the need for ventilation.
 - → [B05: Chronic Obstructive Pulmonary Disease](#)
- Regardless of SpO₂, treat the following illness with high concentration oxygen (15 L/min via NRFM):
 - Toxic inhalation, decompression sickness, cord prolapse, postpartum haemorrhage, shoulder dystocia, and cluster headache
 - → [J01: Approach to Toxic Exposures](#)
 - → [I03: Dive / SCUBA Injuries](#)
 - → [L08: Maternity: Delivery Complications](#)

References

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4. Misasi P, et al. Medication safety in emergency medical services: approaching an evidence-based method of verification to reduce errors. 2019. [\[Link\]](#)
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B01: Airway Management

Mike Sugimoto

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Introduction

Airway management sits at the core of effective patient management in prehospital 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 transport times. The interplay between these factors can be complex and daunting regardless of the experience of individual paramedics.

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 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 diffusion across the alveolar wall, 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 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 as opposed to a technical imperative.
- If unable to ventilate in an apneic, unconscious patient, begin chest compressions regardless of the presence of a pulse and proceed as for an obstructed airway.
- The elastomeric half-face respirator (EHFR) is the primary device to be used for respiratory protection during COVID-19. If an N95 is worn, it can be used for the full duration of a shift. The N95 mask and/or face shield should be replaced or discarded if it becomes grossly contaminated with blood, secretions, or body fluids. The N95 respirator and/or face shield must be discarded if it becomes obviously soiled or damaged (e.g., creased, torn, or saturated) or if visibility is impaired. Paramedics are required to wear a procedure mask over the exhalation port as the exhalation port on EHFRs are not filtered.

Additional Treatment Information

- 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, but 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, for most cases, requires two operators: one to maintain a mask seal and provide a jaw thrust, the other to provide ventilations. Lift the patient's face into the mask while providing ventilations. Exposure of the patient to visualize chest rise and fall is essential; deliver only enough volume to see chest rise. Avoid high tidal volumes and hyperventilation.
- Critically ill patients can be supported by use of a nasal cannula with a maximum flow of 5 L/min in addition to a bag-valve mask (NODESAT or nasal cannula technique). The inclusion of a PEEP valve in this scenario provides for maximal oxygen delivery in the prehospital 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 FiO₂ 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 movement, 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 prehospital 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 wall, the binding 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, but paramedics 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 FiO₂ 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 needed. 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.
- Provide supplemental oxygen as required to maintain SpO₂ ≥90%.
 - → [A07: Oxygen and Medication Administration](#)
- Functional airway obstruction present:
 - Attempt placement of oropharyngeal airway.
- Provide optimized bag-valve mask ventilation as necessary. Clinicians should provide a tight seal with the BVM using a 2-person technique where possible.
- Monitor and provide ongoing care until paramedic arrival.

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.
- Consider higher level of care intercept where available.

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

- Supraglottic airway devices with a viral filter may be used to support oxygenation and ventilation in accordance with AIME principles, 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 raise SpO₂ above 90%, consider use of PEEP.
 - → [PR10: Positive End Expiratory Pressure](#)
- Consider use of CPAP (requires CliniCall consult; see individual CPGs for specific guidance)
 - → [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 must be consulted prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.
 - → [PR23: Awake Intubation](#)
- Consider induction for intubation. CliniCall must be consulted prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.
 - → [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](#)

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

- May consider rapid sequence intubation as required.

Evidence Based Practice

[Intubation](#)

[Alternative Rescue Airway Management](#)

[Medication for Airway Management](#)

[Airway Confirmation](#)

B02: Airway Obstruction

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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 narrowing of the upper airway, or trauma to the mouth, face, head, and 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 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 at the core of the 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, and then resume chest compressions.
- Consider the use of patient positioning while attempting to manage partial airway obstructions, especially in 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 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 transport, with ACP/CCP intercept and hospital notification, is indicated for persistent airway obstruction, whether partial or complete.
- The elastomeric half-face respirator (EHFR) is the primary device to be used for respiratory protection during COVID-19. If an N95 is worn, it can be used for the full duration of a shift. The N95 mask and/or face shield should be replaced or discarded if it becomes grossly contaminated with blood, secretions, or body fluids. The N95 respirator and/or face shield must be discarded if it becomes obviously soiled or damaged (e.g., creased, torn, or saturated) or if visibility is impaired. Paramedics are required to wear a procedure mask over the exhalation port as the exhalation port on EHFRs are not filtered.

Additional Treatment Information

- Abdominal or chest thrusts are indicated for complete airway obstructions in conscious patients. Use chest thrusts in pregnant women or the obese; 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 video laryngoscopy and a surgical airway. Under laryngoscopic visualization, foreign bodies may be removable using Magill forceps – do not attempt to blindly insert forceps into

the airway. Direct laryngoscopy may be required in some cases of FBAO but should otherwise be avoided.

- High vacuum suction, coupled with the Ducanto catheter, may help relieve some airway obstructions. Exercise extreme caution when applying suction.
- Advanced providers should have a low threshold to perform a surgical airway in patients who cannot be ventilated effectively where the obstruction cannot be visualized or readily removed, or 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 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 transported for observation and evaluation.
- Patients with resolved partial airway obstructions, who are no longer symptomatic and are not experiencing any distress, may be left at home in consultation with CliniCall.
- Pathological airway obstructions must be transported for evaluation and treatment.

General Information

- In adults, eating is the most common precipitating event in 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, and effective bag-valve mask ventilation 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: have patient wear procedure mask and encourage patient to cough.
- For complete airway obstruction **in conscious patients**: begin abdominal thrusts.
 - In children under 1 year of age, administer alternating sequence of five back blows and five 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. Remove foreign bodies if seen. Do not attempt blind finger sweeps.

Emergency Medical Responder – All FR interventions, plus:

- Initiate transport with notification.
- Consider ACP/CCP intercept.

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

- Initiate transport with notification.
- Consider ACP/CCP intercept.

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

- As above, plus:
 - Consider video laryngoscopy for FBAO removal using Magill forceps, with or without suction. Direct

laryngoscopy may be required in some cases of FBAO but should otherwise be avoided.

- Consider surgical airway.
 - → [PR22: Surgical Airways](#)

Evidence Based Practice

[Foreign Body Obstructions](#)

References

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N02: Adult Cardiac Arrest

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Introduction

Sudden cardiac arrest (SCA) and sudden cardiac death (SCD) refer to the sudden cessation of cardiac activity and subsequent hemodynamic collapse. Victims of SCA manifest one of four electrical rhythms: ventricular fibrillation (VF), pulseless ventricular tachycardia (pVT), pulseless electrical activity (PEA), and asystole.

Ventricular fibrillation represents a disorganized electrical activity in the ventricles. Pulseless ventricular tachycardia is an organized electrical activity of the ventricles; neither VF nor pVT have any meaningful cardiac output. Pulseless electrical activity, as a term, encompasses a heterogeneous group of organized electrical rhythms that are associated with either an absence of mechanical activity, or mechanical activity that is insufficient to generate a detectable pulse. Asystole (more specifically ventricular asystole) represents the absence of detectable ventricular electrical activity, with or without atrial electrical activity.

Survival from these rhythms requires both effective basic life support (BLS), and a system of advanced cardiovascular life support (ACLS) with integrated post-cardiac arrest care. An understanding of the importance of diagnosing and treating underlying causes is fundamental to the management of all cardiac arrest rhythms. During a cardiac arrest, paramedics should apply a systematic approach in searching for any factors that may have caused the arrest, or that may be complicating resuscitation efforts.

Essentials

- High quality continuous CPR.
- Early rhythm analysis & defibrillation if indicated.
- Appropriate airway management.
- Recognition & correction of reversible causes:
 - Hypovolemia
 - Hypoxia
 - Hydrogen ion (acidosis)
 - Hypo/Hyperkalemia
 - Hypothermia
 - Tension pneumothorax
 - Tamponade, cardiac
 - Toxins (including anaphylaxis)
 - Thrombosis, pulmonary
 - Thrombosis, coronary

Additional Treatment Information

- Once the absence of a pulse is established and chest compressions are started, subsequent pulse checks must only be done during periods of analysis, or if signs of spontaneous circulation are observed, such as coughing, movement, or normal breathing.
- Where clear signs of prolonged cardiac arrest are present, or where paramedics consider continued resuscitation futile, **CPG N05** should be consulted for additional guidance.

Referral Information

All patients in the cardiac arrest period should be treated in place with a consideration for immediate transport when reasonable.

General Information

- Available evidence suggests that several therapies or interventions, which have historically been used in resuscitation, should no longer be used routinely:
 - Atropine during PEA
 - Sodium bicarbonate
 - Calcium
 - Magnesium
 - Vasopressin (offers no advantage over epinephrine)
 - Fibrinolysis
 - Electrical pacing
 - Cricoid pressure
 - Precordial thump (associated with a delay in starting CPR and defibrillation)
 - Crystalloid infusion outside of specific reversible causes
- A rhythm change to one of organized electrical activity on the monitor is not an indicator for paramedics to pause chest compressions and assess for a pulse. Changes in EtCO₂ or signs of life are better indicators of return of spontaneous circulation.
- During cardiac arrest, the provision of high quality CPR and rapid defibrillation are the primary goals. Drug administration is a secondary consideration.
 - After beginning CPR and attempting defibrillation as required, paramedics can attempt to establish vascular access, either intravenously or intraosseously. This should be performed without interrupting chest compressions.
 - The primary purpose of IV/IO access during cardiac arrest is to provide drug therapy. It is reasonable for providers to establish IO access if IV access is not readily available.
 - If IV or IO access cannot be established, epinephrine, vasopressin, and lidocaine may be administered endotracheally during cardiac arrest.
 - Cardiac arrest resuscitations using tibial IO access appear to lead to worse outcomes when compared to IV access. Research to date demonstrates that drug delivery through IV and humeral IO sites are approximately the same with tibial being significantly worse. Definitive data does not yet exist though, so based on current information, we recommend the following practices:
 - A proximal IV is the preferred vascular access site for cardiac arrest resuscitation.
 - For cases when an IV cannot be established, humeral IO is the next best option.
 - Tibial IO should only be placed due to failure or delay in obtaining IV or humeral IO access.
 - Consider external jugular cannulation where possible.
 - Cardiac arrests related to opioid overdose are likely to be hypoxic in nature. Effective oxygenation, ventilation, and chest compressions are particularly critical for these patients. Naloxone is unlikely to be beneficial, and its use in cardiac arrest is not supported by current evidence.
 - Refer to [CPG N04](#) for additional details on post-cardiac arrest care.

Interventions

First Responder

Paramedics are required to wear airborne PPE (N95/EHFR, face shield, gown, gloves) before initiating CPR and resuscitation. A surgical mask should be placed over the patient's face before initiating CPR. Defibrillation, when indicated, should be administered as early as possible. Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2-person technique where possible. Chest compressions should pause for ventilations using a 30:2 ratio. An inline viral filter should be used between the mask and the bag-valve device.

- CPR quality:
 - Rate (100-120/min), continuous compressions.
 - Depth (at least 2 inches [5cm]).
 - Ensure full chest recoil.
 - Minimize interruptions in compressions.

- Relieve compressor every 2 minutes, or sooner if fatigued.
- [PR06: High Performance CPR](#)
- Defibrillation: Perform CPR while the defibrillator pads are being applied.
 - Perform CPR while the defibrillator charges. As soon as energy is delivered, resume CPR for 2 minutes prior to reassessing rhythm.
- Ventilation: Avoid excessive ventilation (10-12 breaths/minute or 1 breath every 6 seconds).
 - Administer high-flow O₂ to patients requiring CPR.
 - Consider appropriate airway adjunct.
 - → [A07: Oxygen and Medication Administration](#)
 - → [B01: Airway Management](#)
- Other: Contact ClinicaCall when possible to discuss treatment plan.

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

- Consider placement of supraglottic airway when appropriate.
 - → [PR08: Supraglottic Airway](#)
 - If required, the airway should be managed using an iGel with a viral filter pre-connected before insertion or 2 person bag-valve-mask ventilation using a viral filter and a tight mask seal.
 - Primary Care Paramedics are now permitted to use a modified approach to the in-built suction port available on all iGel supraglottic devices to provide pharyngeal suction during cardiac arrest.
- Vascular access: Consider IV access, when appropriate.
 - → [D03: Vascular Access](#)

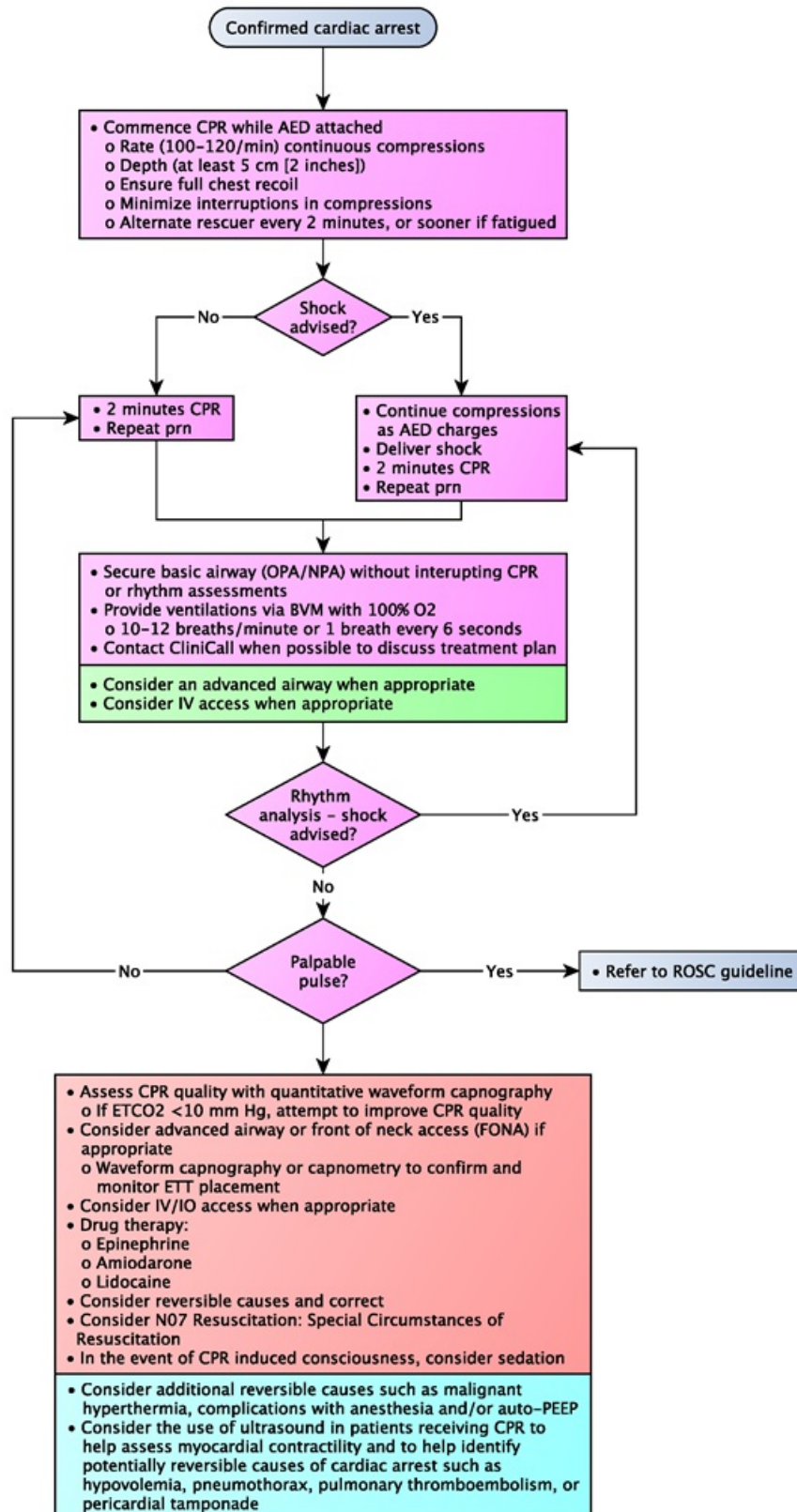
Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- CPR quality: Quantitative waveform capnography.
 - If ET_{CO}₂ <10 mmHg, attempt to improve CPR quality.
- Advanced airway: Consider advanced airway or front of neck access (FONA) if appropriate.
 - In cases of cardiac arrest where effective ventilation and oxygenation cannot be achieved with an iGel, and where 2 person bag-valve-mask technique may not be suitable, tracheal intubation can be considered using video laryngoscopy (VL), when it is safe to do so. Direct laryngoscopy may be required in some cases of foreign body airway obstruction but should otherwise be avoided.
 - Waveform capnography or capnometry to confirm and monitor ETT placement.
- Vascular access: Consider IV/IO access, when appropriate:
 - → [D03: Vascular Access](#)
 - → [PR12: Intraosseous Cannulation](#)
 - → [PR13: External Jugular Cannulation](#)
- Drug therapy:
 - [EPINEPHrine](#): administer EPINEPHrine early in cases of asystole or PEA; defer EPINEPHrine administration until after the first defibrillation in VF/pVT.
 - [Amiodarone](#): administer amiodarone/lidocaine following the *second* defibrillation in VF/pVT.
 - [Lidocaine](#)
- In the event of CPR induced consciousness, consider sedation:
 - [MIDAZOLam](#)

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

- Consider additional reversible causes such as malignant hyperthermia, complications with anesthesia and/or auto-PEEP.
- Consider the use of ultrasound in patients receiving CPR to help assess myocardial contractility and to help identify potentially reversible causes of cardiac arrest such as hypovolemia, pneumothorax, pulmonary thromboembolism, or pericardial tamponade

Algorithm



Evidence Based Practice

[General Cardiac Arrest](#)

References

American Heart Association. 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. 2015. [\[Link\]](#)

American Heart Association. 2020 American Heart Association Guidelines for CPR and ECC. 2020. [\[Link\]](#)

Salbutamol

Classification

Bronchodilator

Sympathomimetic

Indications

■ PCP: Bronchospasm

■ ACP: Adjunctive management of hyperkalemia

Contraindications

- Known hypersensitivity to salbutamol
- Hemodynamically significant tachycardia

Adult dosages

■ PCP: Bronchospasm

- 5 mg nebulized. Repeat doses back to back as necessary.
- **NB: nebulized medication therapy not authorized during Covid.**
- 4 x 100 mcg via metered dose inhaler. Repeat as required.

■ ACP: Adjunctive management of hyperkalemia

- 10-20 mg via nebulizer. May require multiple doses back-to-back to reach total dose.
- **NB: nebulized medication therapy not authorized during Covid.**

Pediatric Considerations And Dosing

[Follow weight-based dosing](#)

■ PCP: Bronchospasm

- Via nebulizer
 - Age < 1 year: 2.5 mg
 - Age > 1 year: 5 mg
 - **NB: nebulized medication therapy not authorized during Covid**
- Via metered dose inhaler:
 - < 10 kg: not indicated
 - < 20 kg: 5 x 100 mcg per round. May repeat up to 3 times.
 - > 20 kg: 10 x 100 mcg per round. May repeat up to 3 times.

Mechanism Of Action

Salbutamol is a selective beta-2 adrenergic agonist that produces bronchodilation and some degree of vasodilation.

Some beta-1 effects can be seen, particularly at higher doses.

Pharmacokinetics

Inhaled:

- Onset: 5 minutes
- Peak: 1.5-2 hours
- Half-life: 3.8 hours
- Duration: 3-8 hours

Adverse Effects

- Restlessness, weakness, vertigo, apprehensiveness
- Nausea and vomiting
- Tachycardia or other dysrhythmias
- Paradoxical worsening of respiratory distress
- Cough
- Pulmonary edema
- Sweating, pallor, flushing
- Tremors

Overdose

Discontinue administration if signs of toxicity are developing: heart rates > 150/minute in adults (> 200/minute in children), or if severe tremors, or ventricular arrhythmias develop.

Ipratropium

Classification

Anticholinergic bronchodilator

Indications

- ACP: Severe bronchospasm in asthma and chronic obstructive pulmonary disease

Contraindications

Known hypersensitivity to ipratropium or any formulation components

Adult dosages

- ACP: Severe bronchospasm in asthma or chronic obstructive pulmonary disease
 - 160 mcg via metered-dose inhaler (8 x 20 mcg sprays)
 - Spacer use recommended, but not required
 - **PREVIOUS DOSING STRATEGY USING NEBULIZERS NOT AUTHORIZED DURING COVID**

Pediatric Considerations And Dosing

- ACP: Severe bronchospasm in asthma or chronic obstructive pulmonary disease
 - Consultation with CliniCall recommended to confirm dosing strategy

Mechanism Of Action

Ipratropium antagonizes the activity of acetylcholine in bronchial smooth muscle, producing bronchodilation and muscle relaxation.

Pharmacokinetics

Inhaled:

- Onset: 1-3 minutes
- Peak: 1.5-2 hours
- Duration: 4-6 hours

Adverse Effects

Adverse effects are similar to other anticholinergics and can include atrial arrhythmias, blurred vision. Coughing is common. Paradoxical bronchospasm can occur during the use of inhaled bronchodilators; this is not the same thing as an inadequate response to treatment.

Overdose

Very high doses of ipratropium (up to 1.2 mg) have been given to volunteers without the development of serious systemic side effects.

Warning And Precautions

- Ipratropium is intended to act synergistically with salbutamol as part of a management plan for bronchospasm. It is not indicated for episodes of acute bronchospasm as monotherapy.
- Avoid spraying ipratropium into the eyes of patients with narrow-angle glaucoma.

EPINEPHrine

Classification

 **HIGH ALERT MEDICATION**

Catecholamine

Sympathomimetic

Indications

- PCP: Anaphylaxis
- PCP: Severe bronchospasm
- PCP: Severe croup
- ACP: Cardiac arrest
- ACP: Peri-arrest hypotension
- ACP: Significant bradycardia

Contraindications

There are no absolute contraindications to EPINEPHrine use in life-threatening situations such as anaphylaxis. Caution should be used in patients with significant tachydysrhythmias, or in the context of hypothermia.

Adult dosages

- PCP: Anaphylaxis
 - 0.5 mg IM every 5 minutes. May repeat up to 3 times.
- PCP: Severe bronchospasm with impending respiratory arrest
 - **MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION.**
 - 0.5 mg IM every 5-20 minutes.
- ACP: Pre-arrest anaphylaxis or bronchospasm
 - 50-100 mcg IV/IO. May repeat as necessary.
- ACP: Cardiac arrest
 - 1 mg IV/IO every 3-5 minutes. Suggested maximum dose of 3-4 mg.
- ACP: Peri-arrest hypotension
 - 10 mcg IV/IO slow push every 2-3 minutes as required.
- ACP: Significant bradycardia
 - 2-10 mcg/minute IV/IO infusion.

Pediatric Considerations And Dosing

[Follow weight-based dosing.](#)

- PCP: Anaphylaxis
 - 0.01 mg/kg IM to maximum of 0.5 mg. May repeat up to 3 times.
- PCP: Severe bronchospasm with impending respiratory arrest

- MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION
- 0.01 mg/kg IM to maximum of 0.5 mg

■ PCP: Severe croup

- 5 mg by nebulizer mask
 - MANDATORY CLINICAL CONSULTATION (1-833-829-4099) PRIOR TO ADMINISTRATION
 - If under 1 year of age: 0.5 mg/kg to maximum of 5 mg
 - Total volume of fluid in nebulizer mask should be 5 mL
 - Requires additional training

■ ACP: Cardiac arrest

- 0.01 mg/kg IV/IO

■ ACP: Pre-arrest anaphylaxis

- 5 mcg/kg IV/IO

■ ACP: Peri-intubation resuscitation

- 1 mcg/kg slow push IV/IO every 2-3 minutes

Mechanism Of Action

EPINEPHrine acts on alpha- and beta-adrenergic receptors. Alpha-adrenergic activity produces vasoconstriction and reduces vascular permeability; beta-adrenergic activity results in bronchial smooth muscle relaxation, increased heart rate, and increased force of cardiac contraction. EPINEPHrine also inhibits histamine release.

Pharmacokinetics

When given intramuscularly or intravenously, EPINEPHrine has a very rapid time of onset, and a relatively short duration of action, which may necessitate repeat doses.

Adverse Effects

Common reactions to systemically administered EPINEPHrine include anxiety, tremor, dizziness, sweating, palpitations, headache, and nausea. Rapid increases in blood pressure and heart rate can occur.

Accidental injection of epinephrine into a digit, hands, or feet may result in a loss of blood flow to the area.

Overdose

EPINEPHrine overdose may produce significantly elevated blood pressures and heart rates, which may in turn cause cerebral hemorrhage.

Warning And Precautions

WARNING: EPINEPHRINE VIALS **MUST** BE STORED IN SPECIALLY-MARKED CONTAINERS AND **NEVER** CO-MINGLED WITH OTHER MEDICATIONS IN KITS OR BINS. INADVERTENT ADMINISTRATION OF EPINEPHRINE TO PATIENTS HAS THE POTENTIAL TO CAUSE SERIOUS HARM OR DEATH.

Patients with underlying coronary artery disease may develop signs and symptoms of angina or myocardial ischemia. Caution should be exercised in these cases.

Drug Interactions

Arrhythmias can develop in patients taking antiarrhythmic medications. Beta-adrenergic blocking drugs can limit the

effectiveness of EPINEPHrine's bronchodilating and inotropic effects.

PR06: High Performance CPR

Applicable To

- EMR and higher

Introduction

The 2015 CPR Guidelines emphasized the importance of providing high quality CPR. The quality and timing of CPR is critical to successful resuscitation in patients who have experienced a sudden cardiac arrest. High performance CPR should be used in all cases of cardiac arrest from a presumed cardiac cause (i.e., not in traumatic arrests).

Procedure

1. Paramedics should adhere to the five principles of high quality CPR by focusing on providing:
 1. Compressions at optimal rates: 100 to 120 compressions per minute
 2. Compressions at an optimal depth of 2" or 5 cm
 3. Complete chest recoil during compressions: after each compression, a negative pressure develops in the chest that pulls blood into the thorax for the next compression. (This is also when coronary arteries are perfused.). Maintaining pressure on the chest wall that results in incomplete chest recoil diminishes or prevents the return of blood into the thorax.
 4. Ventilation at optimal rates: 1 breath every 6 seconds. Paramedics should also be aware of volumes when ventilating; in adult patients, no more than 500-600 mL should be given during CPR.
 5. Minimally interrupted compressions. Pauses during compressions should be limited to 10 seconds or less. Perform pulse checks only while analyzing rhythms, or if signs of spontaneous circulation become evident.
2. When charging monitors and defibrillators prior to delivering shocks:
 1. For AEDs: pause compressions only as long as required to conduct the analysis. Immediately resume compressions once the AED has completed the analysis, even if a shockable rhythm is detected.
 2. With compressions ongoing, verify the presence of a central pulse
 3. Charge the defibrillator (or allow the AED to charge)
 4. Once the defibrillator is charged, stop compressions. Confirm the absence of central pulses.
 5. Clear the patient and deliver the shock
 6. Immediately resume compressions *without* checking for pulses
3. Clear delegation of roles and effective intra-team communication and leadership are fundamental to success in resuscitation efforts

Resources

PR08: Supraglottic Airway

Applicable To

- PCP and higher
- PCP requires completion of AIME BLS II **and** CPD 2019 for use outside of cardiac arrest

Introduction

The iGel supraglottic airway device is a tool used to provide a higher degree of airway protection that can be obtained through the use of a pharyngeal airway. It transfers the working interface between the bag-valve mask from the face to the laryngeal inlet. Paramedics may use supraglottic devices in the setting of cardiac arrest, or in patients who are obtunded and breathing spontaneously.

Indications

Supraglottic airway devices may be placed in patients who are unable to protect their airways due to a decreased level of consciousness.

Primary care paramedics who have not completed AIME BLS II and CPD 2019 may only use supraglottic airway devices in cardiac arrest.

Contraindications

- Inability to place device due to difficulties with mouth opening
- Known or suspected pathological or foreign-body airway obstruction
- Trauma to the trachea, neck or oropharynx
- Caustic ingestion
- Active vomiting
- Relative: Anticipated requirement for high inspiratory pressures during ventilation

Procedure

1. Select an appropriately-sized supraglottic airway and remove it from its packaging and its cradle. EGD sizing is based on patient weight.
2. Place lubricant on the cradle. Lubricate the supraglottic airway on all sides, taking care to avoid the lumen.
3. Open the patient's mouth and introduce the soft tip towards the hard palette
4. Allow the supraglottic airway to glide along the hard palette and advance the device until resistance is felt.
5. Confirm placement by ventilating using a bag-valve mask
6. Secure the supraglottic airway using tape or a commercial tube holder

If it becomes necessary to remove a supraglottic device:

1. Where possible, raise the patient to a semi-recumbent position (30°)
2. Prepare suction, bag-valve mask, and oxygen delivery devices
3. Cut or remove ties or tube holders
4. Ask the patient to take a deep breath, and then blow out firmly. While the patient is blowing out, pull the airway smoothly out of the mouth.
5. Suction the oropharynx as needed.
6. Monitor oxygen saturation.
7. Support respirations as needed.

Notes

- Airway obstructions are an absolute contraindication to use of a supraglottic airway. Paramedics **must**, therefore, confirm they are able to ventilate the patient with a bag-valve mask prior to placing a supraglottic airway.
- The supraglottic airway is a tool to solve problems relating to oxygenation and ventilation. Paramedics should apply a staged approach to airway problem solving prior to using a supraglottic airway.
- PCPs may not suction down either lumen of a supraglottic device
- Do not occlude the suction port of the supraglottic airway

Resources

PR09: Continuous Positive Airway Pressure

Applicable To

- PCP and higher
- PCP requires CliniCall consultation prior to use of continuous positive airway pressure

Introduction

Continuous positive airway pressure (CPAP) devices provide a non-invasive method of improving oxygenation in patients who are experiencing significant respiratory distress. The use of CPAP eases work of breathing, supports alveolar recruitment, decreases overall mortality, and reduces the need for intubation.

Indications

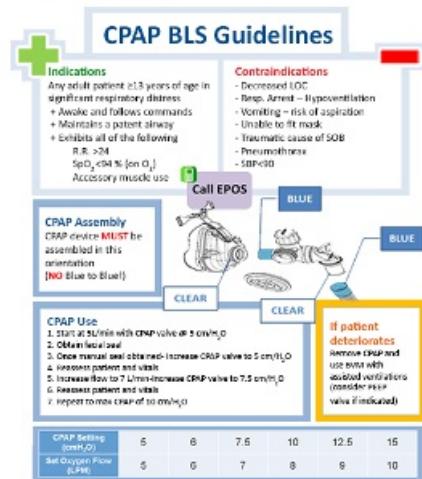
Patients who are:

- Awake and able to follow commands
- Able to maintain an open airway
- Over 13 years of age
- Exhibiting respiratory distress with **all** of the following:
 - Respiratory rate > 24/minute
 - SpO₂ < 94% on supplemental oxygen
 - Use of accessory muscles
- Consider the use of CPAP in adult patients with respiratory distress, including but not limited to:
 - Congestive heart failure or acute cardiogenic pulmonary edema
 - Asthma
 - Submersion injuries
 - Pneumonia
 - Chronic obstructive pulmonary disease

Contraindications

- Patients less than 13 years old
- Decreased level of consciousness, or inability to follow commands
- Respiratory arrest or hypoventilation
 - Patients who are in imminent or actual respiratory failure (i.e., whose respirations are slow, feature shallow tidal volumes, and whose level of consciousness is falling) are not candidates for CPAP. These patients must be ventilated with a bag-valve mask (and may benefit from PEEP use).
- Unable to fit mask to patient's face
- Vomiting or any other risk of aspiration
- Traumatic cause of respiratory distress
- Tracheostomy
- Suspected or known pneumothorax
- Systolic blood pressure < 90 mmHg

Procedure



Primary care paramedics must consult with ClinCall (1-833-829-4099) prior to starting CPAP therapy

- Assemble appropriate equipment. Verify mask sizing by comparing the mask to the patient's face.
- Explain the procedure and obtain consent.
- Position the patient in an upright, sitting position. Attach pulse oximeter.
- Connect the CPAP mask to the oxygen source. Set the flow to 5 LPM if possible (otherwise use 6 LPM).
- Have the patient hold the CPAP mask over their nose and mouth. A progressive application of pressure to obtain a seal may be required to maximize the acceptance of the mask. Paramedics should be calm and reassuring.
- Once the patient appears to be able to tolerate the mask, position the bonnet over the back of the head and attach the straps to the side of the mask. Adjust the Velcro and headpiece for optimal seal.
- Examine the mask seal for leaks. Reassess the patient.
- If SpO₂ remains below 92%, follow the manufacturer's flow rate chart. Incrementally raise the oxygen flow to increase both FiO₂ and CPAP pressure. Do not exceed 10 cmH₂O.

Notes

- Do not attempt to use the CPAP mask for bag-valve ventilations.
- Oxygen saturations may transiently fall during initial CPAP use. Allow time for the mask to work before adjusting the therapy.
- Do not delay the administration of medications to apply a CPAP mask.
- Use conventional therapies (e.g., bronchodilators) first in patients with audible wheezing. Nebulizers, connected to the mask with a T-piece, may be attached to the auxiliary port on the CPAP mask; in this case, increase the oxygen flow rate by 7-8 LPM.
- A do-not-resuscitate order or MOST does not preclude the use of CPAP for relief from shortness of breath.

Resources

References

1. BLS Systems. Rescuer II Compact CPAP System. [\[Link\]](#)

PR18: Anesthesia Induction

Applicable To

■ ACP and higher

Introduction

Anesthesia Planning

In the context of BCEHS practice, planning for anesthesia is synonymous with planning for invasive airway management. Patients who are not completely obtunded will require some level of sedation and anesthesia prior to being intubated, and paramedics must consider multiple factors when planning an induction strategy.

The goals of anesthesia, for all patients, are four-fold:

1. Critical to the long-term psychological well-being of patients being intubated; can be achieved with the use of ketAMINE or mIDAZOLam.
2. In addition to reducing patient discomfort, effective analgesia reduces the amount of sedation required post-intubation. Can be achieved using ketAMINE and fentaNYL.
3. Autonomic stability. Virtually all patients being intubated prehospitally require some degree of resuscitation during the peri-intubation phase. Hypotension post-intubation can be lethal. Autonomic stability can be achieved using fluid and push-dose vasopressors such as PHENYLephrine or EPINEPHrine.
4. The loss of muscle tone and suppression of reflexes improves the overall ability of the intubator to access the trachea. Effective areflexia also lowers the total sedation requirements. It is, however, fraught with complications and can be extremely dangerous. Succinylcholine and rocuronium are used to achieve areflexia; deep sedation does not produce areflexia, but instead suppresses the response to painful stimulus.

Shock Physiology

Maintaining autonomic stability is critical to ensuring patient safety in the peri-intubation period. Because good outcomes cannot be achieved from a poor starting point, all patients must be adequately resuscitated prior to intubation. At a minimum, this involves a fluid bolus of normal saline of at least 500 mL.

The shock index (SI) is calculated by dividing the heart rate by the systolic blood pressure. Normal physiology has a shock index of less than 1; shocked states have an index of greater than 1. An approximation can be made by comparing the heart rate to the systolic blood pressure: if the heart rate is greater than the systolic blood pressure, the patient requires additional support during the peri-intubation phase. In these cases, PHENYLephrine as a push-dose vasopressor is used to help support blood pressure prior to and after intubation. EPINEPHrine is also available as a push-dose vasopressor for critically ill patients who are at imminent risk of cardiac arrest.

Summary of Pharmacology

Goal	Options	Induction	Maintenance	Emergence
Analgesia	fentanyl ketAMINE	Covered with KetAMINE	Covered with ketAMINE	fentaNYL 50 - 100 mcg as required
Amnesia	mIDAZOLam ketAMINE	Adult: ketAMINE 2 mg/kg if SI < 1 ketAMINE 1 mg/kg if SI ≥ 1 Pediatric: ketAMINE 1 mg/kg if perfusion is normal ketAMINE 0.5 mg/kg if hypoperfusion present Consider ½ normal ketAMINE dose if GCS < 8	Use ½ of induction dose every 10-5 minutes as required	mIDAZOLam 1 - 5 mg as required
Autonomic Stability	IV fluids PHENYLEphrine EPINEPHrine	Normal saline 500 mL PHENYLEphrine 100 mcg IV to achieve SBP ≥ 90 mmHg EPINEPHrine 10 mcg slow IV push in peri-arrest	Normal saline 500 mL as required PHENYLEphrine 100 mcg IV as required	Normal saline as required
Areflexia	ROCuronium Succinylcholine	Not available to advanced care paramedics at BCEHS		

Contraindications

- Absolute: inability to monitor oxygenation and ventilation
- Absolute: inability to perform airway interventions
- Relative: traumatic brain injuries
- Relative: hypotension and shock

Consider the use of alternative techniques (e.g., supraglottic airway devices, awake intubation techniques) if induction of anesthesia is judged unsafe, or if it cannot be accomplished due to logistical factors.

Procedure

1. Ensure adequate oxygenation and ventilation throughout the procedure. Monitor pulse oximetry, blood pressure, and heart rate. Assign roles and delegate tasks as part of crew resource management. Consider consultation with ClinCall if clinical situation permits.
2. If not already done, establish vascular access and verify the line is patent.
3. Prepare and label medications, including vasopressors based upon shock index calculation. PHENYLEphrine should be available at all times to manage post-intubation hypotension.

For adult patients

4. Start normal saline bolus of 500 mL
5. If shock index ≥ 1 (or predictors of hypotension are present):
 - [PHENYLEphrine](#) 100 mcg IV/IO every 3-5 minutes as required to maintain systolic blood pressure ≥ 90 mmHg
 - [ketAMINE](#) 1 mg/kg IV/IO
6. If shock index < 1:
 - [ketAMINE](#) 2 mg/kg IV/IO

7. For maintenance:
 - [ketAMINE](#): ½ of the induction dose every 10-15 minutes as required to maintain sedation
 - [fentaNYL](#): 50 to 100 mcg IV/IO every 10-15 minutes as required if pain is believed to be a major factor
 - Normal saline: 250-500 mL as required
 - [PHENYLephrine](#): 100 mcg IV/IO every 3-5 minutes as required to a maximum of 500 mcg. If additional PHENYLephrine is needed, consult with ClinCall

For pediatric patients

4. Start normal saline bolus of 10 mL/kg
5. If signs of inadequate perfusion are present (relative bradycardia, $SBP < 70 + (2 \times \text{age})$):
 - [EPINEPHrine](#) 1 mcg/kg slow IV/IO every 3 to 5 minutes as required
 - ketAMINE 0.5 mg/kg IV/IO
6. In patients with adequate perfusion and heart rate:
 - ketAMINE 1 mg/kg IV/IO
 - EPINEPHrine on "stand-by" 1 mcg/kg slow IV/IO every 3 to 5 minutes as required
7. For maintenance:
 - ketAMINE: ½ of the induction dose every 10-15 minutes as required to maintain sedation
 - MIDAZOLam: consider addition of benzodiazepine at 0.1 mg/kg as required
 - fentaNYL: consider 1 to 3 mcg/kg IV/IO every 10 to 15 minutes if pain is believed to be a major factor
 - Normal saline: 10 mL/kg as required
 - EPINEPHrine: 1 mcg/kg slow IV/IO as required

Resources

(Will either be a link to a YouTube video or embedded or an image)

PR22: Surgical Airways

Applicable To

- ACP and higher

Introduction

A surgical airway is indicated in a patient who cannot be oxygenated or ventilated through other means. Paramedics may also consider preparing for surgical airways based on predicted clinical course, or in cases where endotracheal intubation is required and predicted to be difficult.

In patients over the age of 8, the bougie-assisted cricothyrotomy is the preferred approach. In patients under 8, needle cricothyrotomy can be used.

These procedures can be intimidating. Paramedics should have a thorough understanding of the circumstances under which they may be required, and have a low threshold for their use. They can also be logistically challenging and frequently require more space (and personnel) than anticipated. In most cases, paramedics will want to approach a surgical airway with their non-dominant hand towards the patient's head.

Indications

Inability to ventilate, oxygenate, or intubate a patient.

Contraindications

- **ABSOLUTE: INABILITY TO IDENTIFY LANDMARKS OR AIRWAY STRUCTURES**
- Relative: trauma to the neck.
- Relative: history of perithyroid tumors or radiation to the neck.
- Relative: expanding hematomas or other pathologies distorting structures in the neck.

Procedure

Procedure: Bougie-Assisted Cricothyrotomy

1. Personal protective equipment is required for this procedure. Face shields are critically important: upon puncturing the cricothyroid membrane, a spray of blood is frequently produced.
2. Prehospital bougie-assisted cricothyrotomy and needle cricothyrotomy is considered AGMP. If either of these procedures are needed, crews are directed to proceed with airborne PPE including face-shield, EHFR/N95 mask, gown, and gloves.
3. Assemble required equipment: scalpel blade, bougie, and 6.0 ETT.
4. Identify the landmarks as required.
5. Stabilize the thyroid cartilage with the non-dominant hand. The dominant hand will hold the scalpel and rest on the patient's sternum for stability.
6. Make a 4 cm vertical incision through the skin over the cricothyroid membrane. In cases where the anatomy cannot be palpated or identified prior to making the incision, it may be necessary to extend the incision from the mandible to the sternum.
7. Palpate the cricothyroid membrane and bluntly dissect through the subcutaneous tissue using a finger until the membrane is readily identifiable. Puncture the membrane with the scalpel held horizontally.
8. Remove the scalpel and place a little finger in the incision in the membrane to dilate, and to identify the posterior wall cartilage. Ignore any bleeding at this point.
9. Slide the bougie alongside the little finger into the trachea.
10. Remove the finger and pass the endotracheal tube over the bougie and into the trachea. Only advance the endotracheal tube until the balloon is within the airway and no longer visible. Inflate the balloon.
11. Holding the endotracheal tube firmly, remove the bougie and connect a bag-valve mask. Confirm endotracheal

tube placement with end-tidal CO₂ monitoring, auscultation, bilateral chest rise and fall, and misting of the tube.

Procedure: Needle Cricothyrotomy

Children under the age of 8 should not have open cricothyrotomies as there is an unacceptable risk of causing damage to poorly-developed structures in the airway. Needle cricothyrotomy is an option in these cases. Paramedics must remember this procedure is a bridge to definitive airway management: it is possible, using this technique, to oxygenate (but not ventilate) a patient for a brief period of time, typically 15 to 20 minutes.

1. Assembled required equipment:
 1. 14 or 16-gauge catheter over needle. Remove the flash cap from the needle.
 2. 10 mL syringe
 3. 0 endotracheal tube. Remove the universal connector from the endotracheal tube.
2. Identify landmarks: the cricothyroid membrane in children is located in the same position as adults, and should be palpable through the skin below the thyroid cartilage.
3. Mount the needle and catheter on the syringe. Hold the syringe in the dominant hand, which is stabilized on the patient's mandible.
4. Puncture the skin over the cricothyroid membrane. Once through the skin, the needle tip should be directed caudally (i.e., towards the feet). While stabilizing the needle and catheter with the non-dominant hand, draw back on the syringe and maintain negative pressure. Advance slowly towards the trachea.
5. Once the needle enters the trachea, the plunger will release. Advance the needle slightly, then withdraw the needle while threading the catheter into the trachea.
6. Insert the endotracheal tube connector into the hub of the catheter, and connect a bag-valve mask attached to high-flow oxygen. Ventilate, being aware that higher pressures may be required and that chest rise may not be seen. The pressure relief valve may need to be locked down.
7. Secure the catheter with an occlusive dressing (e.g., Tegaderm).

Notes



SURGICAL CRICOTHYROTOMY - FONA

When do I use it ?



What equipment do I need?

- ☒ #10 Scalpel
- ☒ #6 ETT
- ☒ Bougie
- ☒ 10 mL syringe

What are some key landmarks?

Need support?

Please contact
Learning@bcces.ca
 or your **Regional
 Advanced Practice
 Educator**



How do I use it?

1. Landmark
2. Make incision
3. Place finger
4. Place bougie
5. Pass ETT
6. Secure and Confirm

Personal Protection

Adapt PPE based on your risk assessment, patient's condition e.g. infectious diseases.
 Best practice: full face shield, gloves, N95

What can make it difficult?

Distortion	Trauma, expanding hematoma, infection or other pathology
Access	Obesity, extreme neck flexion (i.e. ankylosing spondylitis)
Radiation	Therapy in area
Tumors	Around cricothyroid membrane

BCEHS Medical Programs & Learning

Last Updated: March 2018

Resources

B03: Asthma and Bronchospasm

Mike Sugimoto

Updated: January 11, 2021

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 SpO₂ <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 as 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 SpO₂ ≥ 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 SpO₂ <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 SpO₂ <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. ClinCall 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_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](#)

B04: Croup and Epiglottitis

Mike Sugimoto

Updated: January 11, 2021

Reviewed:

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. Classically, children adopt a “tripod” position and are reluctant to lie down; coughing is rare. 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 prehospital treatment options are so limited, urgent transport to an appropriate facility is of high importance.
- The onset of croup is slower and is generally associated with a prodromal history of viral symptoms (fever, cough, nasal congestion). 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).
- Croup is most prevalent in children between six months and three years of age, and is uncommon in those over six years old.
- Paramedics should be aware of the possibility of other causes of upper airway obstruction, including foreign bodies, trauma, and inhalation injuries.
- **Epinephrine should not be nebulized for croup.** Clinical and Medical Programs and BC Children’s Hospital specialists are investigating alternatives for paramedic management of croup. Watch for a future practice update.

Additional Treatment Information

- Because the inflammation of croup can extend throughout the respiratory tract, compromising ventilation and oxygenation, paramedics must be aware of the potential for sudden deterioration. An early warning sign of deterioration is a fall in oxygen saturation, but supplemental oxygen can artificially prop up SpO₂, limiting the usefulness of this tool. Patients with croup should not be kept on oxygen and should be monitored closely for other signs of increasing respiratory distress.
- Although cold or hot, humid air can sometimes provide for temporary relief of symptoms in 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, but 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 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 (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

- Position of comfort.
- Provide reassurance.
- Monitor oxygen saturation and provide supplemental oxygen to maintain SpO₂ >90%.
- Provide positive pressure ventilation as required.

Emergency Medical Responder – All FR interventions, plus:

- Transport early.
- Consider ACP intercept.

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

- Epinephrine should not be nebulized for croup. Clinical and Medical Programs and BC Children's Hospital specialists are investigating alternatives for paramedic management of croup. Watch for a future practice update.

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

- Consider need for invasive airway management in severely decompensated patients. CliniciCall must be consulted prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.
- Consider need for antipyresis.

Evidence Based Practice

[Pediatric Stridor](#)

B05: Chronic Obstructive Pulmonary Disease

Christine Hudson and Mike Sugimoto

Updated: January 11, 2021

Reviewed:

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 number of 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. Although oxygen should never be withheld from patients who are acutely short of breath, its administration should be considered 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 must use appropriate personal protective equipment and avoid all aerosol generating procedures until protective measures are in place.
- Recognize that treatment options for COPD exacerbations in the prehospital environment are limited. Extrication and transport should be accomplished as soon as practical and safe. Do not exert patients during transfers.

Referral Information

Patients with COPD are at significant risk for recurrent hospital admissions due to exacerbation of their disease. Paramedics should investigate whether patients have action or management plans and assess their compliance with these programs. Self-management strategies have been demonstrated to reduce hospital admissions and improve quality of life for patients living with chronic diseases, including COPD. Referral to community care organizations, either independently or through the emergency department, may be appropriate in these cases. Referral to community paramedicine programs, where available, may also provide significant improvements in quality of life.

Patients who return to baseline norms for their disease may be left at home in consultation with the CliniCall referral pathway, but in general, an exacerbation of COPD that requires paramedic attendance should be further investigated.

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 a COPD exacerbation.
- Complete relief of symptoms, including audible wheezes, is frequently not possible. Although paramedics 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 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 should consider the possibility of concurrent disease processes and seek evidence to include or exclude other diagnoses.

Interventions

First Responder

- Minimize patient activity and do not exert patients during transfer.
- Titrate supplemental oxygen to SpO₂ 88-92%.
 - → [A07: Oxygen and Medication Administration](#)
- Place patient in position of greatest comfort and easiest breathing (generally sitting up).
- Assist patient with use of own inhalers if prescribed.
- Begin positive pressure ventilation using bag-valve masks if respiratory failure develops. Provide a tight seal with the BVM using a 2-person technique where possible.

Emergency Medical Responder – All FR interventions, plus:

- Transport early.
- Consider ACP intercept.

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

- [Salbutamol via MDI](#).
- Consider CPAP (required CliniCall consult)
 - → [PR09: Continuous Positive Airway Pressure](#)
 - 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).

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

- [Salbutamol](#) and [ipratropium](#) via MDI.
- Consider dexamethasone.
- Intubate as necessary. CliniCall must be consulted prior to attempting intubation for patients with perfusing rhythms who are breathing spontaneously.

Community Paramedic (CP) Interventions

- → [CP09: Chronic Obstructive Pulmonary Disease](#)

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

- Consider use of BiPAP ventilation.

Evidence Based Practice

[Chronic Obstructive Pulmonary Disease](#)

References

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- ipratropium and albuterol is more effective than either agent alone. 1994. [\[Link\]](#)
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N01: Peri-Arrest Management

Jennie Helmer

Updated: July 20, 2021

Reviewed:

Introduction

The peri-arrest period is the time either before or immediately following a full cardiac arrest, when the patient's condition is unstable. Paramedics caring for a patient in the peri-arrest period (the so-called "crashing patient") have an opportunity to significantly improve outcomes in comparison to patients in cardiac arrest, provided they are able to recognize and respond to signs of imminent deterioration.

Essentials

A significant body of research demonstrates that many patients exhibit signs of clinical deterioration before experiencing cardiac arrest. The following features indicate that a patient is at high risk of being peri-arrest:

- Shock/hypotension (systolic blood pressure <90 mmHg), pallor, sweating, cold clammy extremities, confusion or impaired consciousness, poor oxygenation.
- Syncope: transient loss of consciousness due to global reduction in blood flow to the brain.
- Myocardial ischemia: typical ischemic chest pain and/or evidence of myocardial ischemia on 12-lead ECG.
- Heart failure: pulmonary edema and/or raised jugular venous pressure.
- Cardiac arrhythmias (relatively common in the peri-arrest period).

Additional Treatment Information

The specific clinical findings will dictate the need for appropriate immediate treatment in the peri-arrest period. Depending on the nature of any underlying arrhythmia and clinical status of the patient, in particular the presence or absence of adverse features, immediate treatment options for patients in the peri-arrest period can be divided into four categories:

1. No treatment needed.
2. Simple clinical interventions (e.g., Vagal maneuvers).
3. Pharmacological therapies.
4. Electrical therapies (e.g., cardioversion or pacing).

Most drugs act slowly, and less reliably, than electrical treatments, so defibrillation or cardioversion is generally preferred for unstable patients with adverse features. Once treated, paramedics must continue to assess and monitor the patient to detect any additional abnormalities that may require treatment.

ACPs and above may consider the use of prophylactic antiarrhythmics following the successful termination of ventricular fibrillation or ventricular tachycardia. Although there are no studies that demonstrate improvement in long-term survival, the continued use of antiarrhythmic agents (particularly in cases where one was used to terminate a lethal arrhythmia) may be beneficial in maintaining a stable, perfusing rhythm and is supported by current American Heart Association Emergency Cardiovascular Care guidelines.

General Information

Non-technical skills such as leadership, teamwork, communication and situational awareness enables a more effective response to the deteriorating patient and are critical to ensuring an appropriate response to patients in the peri-arrest period.

If the patient is palliative or otherwise at the end of their life, treat in accordance with relevant clinical practice guidelines.

Interventions

First Responder

- Position patient supine, if appropriate. Warning: Do not ambulate the patient.
- Supplemental oxygen as required:
 - → [A07: Oxygen and Drug Administration](#)
 - Paramedics should use the lowest oxygen flow rate possible to achieve an SpO₂ of ≥90%. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB, CPAP or BVM when flow rates above 5 L/min are required.
- Position defibrillator electrodes in anticipation of cardiac arrest.

Emergency Medical Responder – All FR interventions, plus:

- Use vital signs and patient observations to recognize deterioration, and to guide decision-making.
- Supplemental oxygen as required to maintain SpO₂ ≥90%:
 - → [A07: Oxygen and Drug Administration](#)
 - Paramedics should use the lowest oxygen flow rate possible to achieve an SpO₂ of ≥90%. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB, CPAP or BVM when flow rates above 5 L/min are required.
- Initiate transport to nearest emergency department, with notification.
- Consider ACP intercept but do not wait for ACPs to arrive.

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

- Treat presenting symptoms per relevant BCEHS Clinical Practice Guidelines.

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

- Treat presenting symptoms per relevant BCEHS Clinical Practice Guidelines.

References

1. Massey D, et al. What factors influence ward nurses' recognition of and response to patient deterioration? An integrative review of the literature. 2017. [\[Link\]](#)
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N03: Return of Spontaneous Circulation

Kevin Hons

Updated: January 11, 2021

Reviewed:

Introduction

Return of spontaneous circulation (ROSC) is the resumption of sustained perfusing cardiac activity following cardiac arrest. Regardless of the cause of the cardiac arrest, the hypoxemia, ischemia, and reperfusion that occur during cardiac arrest and resuscitation may damage multiple organ systems. The severity of this damage can vary widely among patients, and even among organ systems within individual patients.

Effective post-cardiac arrest care consists of identification and treatment of the precipitating cause of cardiac arrest, combined with the assessment and mitigation of ischemia and reperfusion injury to multiple organ systems.

In the prehospital environment, ROSC management is oriented towards maintaining appropriate oxygenation, ventilation, and hemodynamics, while attempting to identify the precipitating cause, and initiating rapid transport to hospital for further diagnostics and interventions.

Essentials

- Target oxygenation and ventilation to SpO₂ of 94-99%, and EtCO₂ of 30-40mmHg.
- Avoid hypotension. The target systolic blood pressure is >100 mmHg (or a mean arterial pressure >65 mmHg). Limit fluid bolus to a maximum of 20 mL/kg unless treating suspected hypovolemia.
- Allow approximately 10 minutes of perfusion before attempting to acquire a 12-lead ECG.
- Elevate the head of cot to 30° where possible.
- Allow passive cooling via minimal blankets and using room temperature saline when fluid bolus is required. Do not allow passive cooling in cases of traumatic cardiac arrest.
- Manage dysrhythmias in accordance with the appropriate CPG.
- Consult the [Post Arrest Checklist](#) for additional guidance.
- Consider the etiology of the cardiac arrest and treat according to appropriate CPG.

Additional Treatment Information

- Manage the airway in a staged approach based upon license level.
 - If the patient is able to maintain adequate oxygenation and is ventilating effectively, provide supplemental oxygen only. Titrate oxygen flow rates to the minimum required to maintain SpO₂ ≥94%. If pulse oximetry is unreliable because of peripheral perfusion deficits, use the highest available oxygen concentration.
 - Patients who remain comatose following a return of spontaneous circulation may have an advanced airway (either a supraglottic device or an endotracheal tube) placed. Maintain EtCO₂ between 30 and 40 mmHg. Monitor the patient for changes in level of consciousness, and consider the need for sedation or removal of the airway device should a gag reflex return.
- Hypotension may be managed with normal saline boluses up to 20 mL/kg as required. Large volumes of saline are associated with poor outcomes; paramedics should aim to maintain a systolic blood pressure of 100 mmHg (or a mean arterial pressure of 65 mmHg).
- EPINEPHrine is the preferred vasopressor in post-arrest care.
- The initial post-arrest phase can have bizarre and atypical cardiac rhythms. Treat sustained dysrhythmias in accordance with the appropriate guidelines. Allow at least 10 minutes following the return of spontaneous circulation for the rhythm to stabilize prior to acquiring a 12-lead ECG.
- Except in cases of traumatic cardiac arrest, allow for passive cooling.
- Elevating the head of bed to 30° promotes cerebral drainage and reduces the incidence of cerebral edema and aspiration.
- Check blood sugar and treat hypoglycemia accordingly.

Referral Information

Patients who have been resuscitated from cardiac arrest and who have an identified STEMI on 12-lead ECG, or who have a suspected cardiac cause of their arrest, should be transported to the closest PCI center. If there is no PCI center within a reasonable transport time, the closest hospital must be selected.

Post arrest patients with suspected non-cardiac causes should be transported to the closest hospital.

General Information

- In patients who achieve ROSC after out of hospital cardiac arrest, subsequent morbidity and mortality are due largely to the cerebral and cardiac dysfunction that accompanies prolonged systemic ischemia. This syndrome, called the post cardiac arrest syndrome, comprises anoxic brain injury, post cardiac arrest myocardial dysfunction, systemic ischemia/reperfusion response, and persistent precipitating pathology.
- In hospital treatment for post cardiac arrest syndrome will vary depending on the length of the cardiac arrest, the cause of the arrest, and the pre-existing co-morbidities of the patient.
- In a series in which consecutive post-cardiac arrest patients with a suspected cardiovascular cause were taken to coronary angiography, a coronary artery lesion amenable to emergency treatment was found in 96% of patients with ST elevation and in 58% of patients without ST elevation.
- Although targeted temperature management has been shown to be beneficial in post-arrest care in hospital, there is no evidence to suggest that active prehospital cooling has a positive effect on either survival or neurological recovery. Evidence has demonstrated that large infusions of cool normal saline can adversely affect outcomes.
- Hypothermia below 35°C has a negative effect on the clotting cascade and therefore should be avoided in ROSC following a traumatic cardiac arrest.
- The clamshell can be an excellent tool in extricating the non-traumatic post arrest patient. Once the patient has been extricated to the stretcher, the clamshell should be removed to allow 30° head up positioning.

Interventions

First Responder

- OPA/BVM/O₂ as required.
 - → [A07: Oxygen and Medication Administration](#)
 - Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2-person technique where possible. An inline viral filter should be used between the mask and the bag-valve device.

Emergency Medical Responder – All FR interventions, plus:

- Oxygenation and ventilation.
 - OPA/BVM/O₂ as required to maintain SpO₂ ≥94%.
 - → [A07: Oxygen and Medication Administration](#)
 - → [B01: Airway Management](#)
 - Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2 person technique where possible. An inline viral filter should be used between the mask and the bag-valve device.
- Head up 30° on cot.
- Passive cooling.
- Rapid transport.
- Refer to [Post Arrest Checklist](#).

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

- Oxygenation and ventilation.
 - Consider Supraglottic Airway (SGA).
 - → [PR08: Supraglottic Airway](#)
 - If required, the airway should be managed using an iGel with a viral filter pre-connected before insertion or 2 person bag-valve-mask ventilation using a viral filter and a tight mask seal.

- Hypotension
 - Establish IV access and give fluid bolus.
 - → [D03: Vascular Access](#)
- Refer to [Post Arrest Checklist](#).

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

- Oxygenation and ventilation.
 - Consider intubation early if not already done.
 - In cases of ROSC where effective ventilation and oxygenation cannot be achieved with an iGel, and where 2 person bag-valve-mask technique may not be suitable, tracheal intubation can be considered using video laryngoscopy (VL), when it is safe to do so.
 - Target SpO₂ to 92%-98%.
 - End tidal CO₂ monitoring (EtCO₂): 35-45 mmHg.
- Hypotension
 - Push dose [EPINEPHrine](#).
 - Target systolic blood pressure >90 mmHg.
 - Target mean arterial pressure >65 mmHg.
 - Refer to push dose vasopressor guideline.
- Dysrhythmia
 - Treat as per appropriate CPG.
- Perform 12-Lead ECG (minimum 10 minutes post-ROSC).
 - → [PR16: 12-Lead ECG](#)
- Refer to [Post Arrest Checklist](#)

Evidence Based Practice

[Post-Cardiac Arrest Care](#)

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N04: Traumatic Cardiac Arrest

Adam Greene and Scott Haig

Updated: January 11, 2021

Reviewed:

Introduction

A traumatic cardiac arrest is a cardiac arrest that occurs secondary to either blunt or penetrating trauma. The most common cause of traumatic cardiac arrest is hemorrhage. Other causes include tension pneumothorax, cardiac tamponade, and hypoxemia. Although traumatic cardiac arrest has a high mortality rate, the neurological outcomes are better in those who survive compared to other causes of cardiac arrest. Patients who have some signs of life upon the arrival of paramedics, or who initially present in pulseless electrical activity, and who subsequently achieve a return of spontaneous circulation, have the greatest probability of survival to hospital discharge.

Successful resuscitation requires simultaneous attention to assessment, airway management, and hemorrhage control.

Essentials

- Consider underlying medical causes of the cardiac arrest.
- Prioritize treatment of reversible causes over chest compressions in order of clinical precedence.
- Simultaneously attempt to identify and treat:
 - Hypovolemia
 - Hypoxemia
 - Tension pneumothorax
- Consider special circumstances.
- Consult with CliniCall to discuss treatment plan or early transport options.
- Consider discontinuing resuscitation efforts if interventions do not result in a return of spontaneous circulation.

Additional Treatment Information

- Interventions in traumatic cardiac arrests should be prioritized based on clinical relevance. Paramedics should focus initially on controlling major hemorrhage through the appropriate use of direct pressure, tourniquets, and wound packing.
- Advanced airway management should not delay transport in urban areas where the traumatic arrest is the result of penetrating thoracic trauma, the presenting rhythm is PEA, and the time from loss of pulses to a trauma center is less than 15 minutes (20 minutes in the Vancouver Coastal-Urban region).
- Bilateral needle thoracentesis (or finger thoracostomy) should be performed on all traumatic arrests with blunt or penetrating chest trauma. The preferred site for needle thoracentesis is the 5th intercostal space in the mid-axillary line. An alternative site is the 2nd intercostal space on the mid-clavicular line, although this requires catheters longer than 5 cm. Prehospital needle thoracentesis should be considered AGMP. Although this is a low occurrence procedure, it does potentially expose the practitioner to an increased risk of exposure. If this procedure is needed, crews are directed to proceed with airborne PPE including face-shield, EHFR/N95 mask, gown, and gloves.
- Obtain large-bore intravenous (or intraosseous) access and administer a bolus of 20 mL/kg.
- In blunt force cardiac arrest, a pelvic binder may be applied after addressing other reversible causes. If a pelvic fracture is suspected of being a significant contributing factor, the binder should be placed earlier.

General Information

- The primary etiologies targeted by prehospital treatments include hypoxia, obstructive shock (specifically tension pneumothorax) and hypovolemia.
- Patients frequently present in an organized electrical rhythm on the monitor with no palpable pulses. It has been shown that in these situations there is often a low perfusion state due to hypovolemia or vascular and cardiac

obstruction preventing adequate perfusion. For management of major hemorrhage, volume replacement with large NS bolus or bilateral chest decompression may result in ROSC.

- Traumatic cardiac arrests with an initial rhythm of asystole, or wide complex PEA of less than 40 beats per minute are generally associated with poor outcomes. It is reasonable to consider early discontinuation of resuscitation if there is no response to treatment.

Interventions

First Responder

- Simultaneous on-scene correction of reversible causes:
 - Hypovolemia: control external hemorrhage, splint pelvis/fractures.
 - Oxygenation: consider appropriate airway adjunct. Maximize oxygenation.
 - → [A07: Oxygen and Drug Administration](#)
- High quality CPR when practical:
 - → [PR06: High Performance CPR](#)
 - Paramedics are required to wear airborne PPE (N95/EHFR, face shield, gown, gloves) before initiating CPR and resuscitation. A surgical mask should be placed over the patient's face before initiating CPR. Defibrillation, when indicated, should be administered as early as possible. Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2 person technique where possible. Chest compressions should pause for ventilations using a 30:2 ratio. An inline viral filter should be used between the mask and the bag-valve device.
 - Rate (100-120/min) continuous compressions.
 - Depth: At least 2 inches [5cm].
 - Ensure full chest recoil.
 - Minimize interruptions of compressions.
 - Relieve compressor every 2 minutes, or sooner if fatigued.

Emergency Medical Responder – All FR interventions, plus:

- Consider primary medical cause – see [CPG N02: Adult Cardiac Arrest](#)
- Prioritize treatment of reversible causes over chest compressions based on clinical precedence.
- Consider recognition of life extinct – see [CPG R03](#)

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

- Simultaneous on-scene correction of reversible causes:
 - Hypovolemia
 - Establish vascular access, consider 20 mL/kg fluid bolus.
 - Oxygenation:
 - Consider supraglottic device.
 - If required, the airway should be managed using an iGel with a viral filter pre-connected before insertion or 2 person bag-valve-mask ventilation using a viral filter and a tight mask seal.

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

- Simultaneous on-scene correction of reversible causes:
 - Oxygenation
 - Consider supraglottic device, endotracheal intubation, or surgical airway.
 - In cases of cardiac arrest where effective ventilation and oxygenation cannot be achieved with an iGel, and where 2 person bag-valve-mask technique may not be suitable, tracheal intubation can be considered using video laryngoscopy (VL), when it is safe to do so.
 - Tension pneumothorax
 - [Bilateral needle or finger thoracostomy](#)
 - Prehospital needle thoracocentesis should be considered AGMP. Although this is a low occurrence procedure, it does potentially expose the practitioner to an increased risk of exposure. If this procedure is needed, crews are directed to

proceed with airborne PPE including face-shield, EHFR/N95 mask, gown and gloves.

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

- Simultaneous on-scene correction of reversible causes:
 - Hypovolemia
 - Consider blood product resuscitation.
 - Consider resuscitative balloon for occlusion of the aorta.
 - Tension pneumothorax
 - [Bilateral needle, finger, or tube thoracostomy.](#)
 - Prehospital needle thoracentesis should be considered AGMP. Although this is a low occurrence procedure, it does potentially expose the practitioner to an increased risk of exposure. If this procedure is needed, crews are directed to proceed with airborne PPE including face-shield, EHFR/N95 mask, gown and gloves.
 - Pericardial tamponade
 - Pericardiocentesis.

Evidence Based Practice

[Traumatic Arrest](#)

References

Traumatic Arrest

Practice Updates

1. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [[Link](#)]
2. American College of Surgeons. Advanced Trauma Life Support Student Course Manual. 10th Edition. 2018. [[Link](#)]
3. Sinz E, et al. ACLS for Experienced Providers: Manual and Resource Text. 2015.

M06: Pediatrics - Cardiac Arrest

Brian Thornburn

Updated: December 21, 2020

Reviewed:

Introduction

Pediatric cardiac arrest is a rare event. Most pediatric cardiac arrests occur in children younger than one year of age, and 90% occur secondary to hypoxia due to respiratory failure. There are many rare causes of pediatric cardiac arrest including sudden infant death syndrome (SIDS), submersion or drowning, trauma, and sepsis. In contrast to cardiac arrest in adults, cardiopulmonary arrest in infants and children is rarely a sudden event, and does not often result from a primary cardiac cause. In cases of sudden collapse in older pediatric patients and patients with congenital heart disease, a primary cardiac cause should be considered.

Essentials

- Prepare, in advance, any calculations that may be necessary to provide care for pediatric patients. A Broselow tape, the BCEHS Handbook, and many other tools are available that can simplify this process.
- Recognize that in the majority of cases, respiratory failure is the primary cause of cardiac dysfunction. Focus on adequate oxygenation and ventilation.
- Be aware that these are some of the most stressful types of prehospital events. Pre-arrival planning, and effective crew resource management, are essential for ensuring an organized approach and high quality CPR.
- High quality CPR, appropriate ventilation, timely vascular access, and a moderate scene time (10 to 35 minutes) are proven elements that improve survival from cardiac arrest with good outcomes.
- Resuscitation and cardiac emergencies for neonates (<28 days of age) differ in approach than that for older patients. See [CPG M11](#) and [CPG M13](#) for additional information.
- When an infant or child is found without a pulse, treatment should first be directed towards adequate ventilation and oxygenation, and maintenance of circulation by chest compression.
- Commotio cordis (cardiac concussion) refers to blunt, non-penetrating, precordial chest impact that causes arrhythmia or sudden death without evidence of cardiac injury. It is from low-impact trauma, and significant signs of trauma are usually not found.

Additional Treatment Information

- Once oxygenation and high quality CPR have been established all infants and children in cardiac arrest should have a defibrillator attached to determine if a shockable rhythm is present. If there is a history of blunt trauma to the chest, electrocution, or the patient has a cardiac history, oxygen and CPR are still the priority, but paramedics should apply the AED with greater urgency as these patients may be more likely to demonstrate a shockable rhythm.
- If ventricular fibrillation is demonstrated, defibrillation should be attempted as soon as possible.
- Rhythm analysis and defibrillation are appropriate for all pediatric cardiac arrests regardless of age. A manual defibrillator is preferred for infants less than 1 year of age however if not available an AED with a pediatric attenuator is appropriate.
- An AED with a pediatric attenuator is preferred for children less than 8 years of age. If neither a manual defibrillator nor an AED with pediatric attenuator is available, an AED without a dose attenuator may be used for any pediatric cardiac arrest.
- AEDs that deliver relatively high energy doses have been used in infants with minimal myocardial damage and good neurological outcomes
- For pulseless ventricular tachycardia, or ventricular fibrillation, an initial dose of 2 J/kg is indicated when using manual defibrillators. If the initial shock fails and the patient is not hypothermic perform defibrillation at 4 J/kg.
- Drugs and advanced airways do not affect outcomes of pediatric cardiac arrest. While still indicated, time and priorities should focus on high quality CPR, ventilation and defibrillation if indicated. Do not stay on scene to justify intubating or providing drugs.
- For patients whose cardiac arrest is a result of traumatic injuries, rapid transport to a trauma center is the most important treatment. En route management and early notification to a receiving facility are the major prehospital

contributors to patient survival. In penetrating trauma, particularly penetrating chest trauma, a small percentage of patients can survive a cardiac arrest with early emergency thoracotomy. These are almost always patients who have demonstrated at least some signs of life in the prehospital setting.

- Needle decompression: in the setting of blunt traumatic cardiac arrest, bilateral needle decompression is appropriate any time the patient is in pulseless electrical activity.
 - Bilateral decompression is used because of the unreliable clinical examination in this patient subset
 - Assume a tension pneumothorax is present in all cases of cardiac arrest with penetrating chest trauma

Referral Information

All pediatric cardiac arrest patients with ROSC require emergency transport to hospital. Pediatric patients with a prolonged pulseless condition should be discussed with ClinCall. Non-viable or futile cases should also be discussed with ClinCall.

General Information

- Bystander CPR plus early defibrillation can more than double the rate of survival from out of hospital cardiac arrest. As such, paramedics should perform full resuscitation in settings where first responder or bystander CPR has been initiated unless obvious signs of death are present.
- Although survival from asystole or pulseless electrical activity is rare, patients who receive immediate, high quality CPR occasionally survive.
- Asystole in cardiac arrest is usually an ominous prognostic sign indicating prolonged hypoperfusion and myocardial ischemia with deterioration to asystole from more treatable dysrhythmias. Asystole must be confirmed in two or more leads.
- Pulseless electrical activity is evidence of organized electrical activity on the ECG without effective myocardial contraction. Patients with wide complex PEA rhythms usually have poor survival and there are often indications of severe malfunction of the myocardium or cardiac conduction system. There are numerous possible causes of PEA, some of which are amenable to pre-hospital treatment. Paramedics should follow a step-wise approach to identifying and treating reversible causes of PEA.
- Special consideration must be given to hypothermic patients without a pulse. As hypothermia progresses, the patient's respiratory and heart rate slow significantly. For this reason, breathing and pulse checks must be sufficiently long (60 seconds) to register very slow rates.
 - "Circum-rescue collapse" is a term that describes a death that occurs shortly before, during, or soon after rescue from exposure to a cold environment, usually cold water immersion. It often presents as an apparently stable, conscious patient who suffers ventricular fibrillation and cardiac arrest shortly thereafter.
 - A patient with a core body temperature below 30°C will most likely develop arrhythmias with progression to ventricular fibrillation.
 - Medications are more slowly metabolized in hypothermic patients; toxic levels of medications may accumulate if normal dosing regimens are used, therefore, prolong repeat times to twice the normal interval and limit vasopressors to a maximum of 3 doses.
- The most common causes of traumatic cardiac arrest include:
 - Hypoxemia from airway obstruction and hypoventilation
 - Obstructive shock resulting from cardiac tamponade or pneumothorax
 - Hemorrhagic shock, from any source of major hemorrhage
 - Myocardial contusions cause dysrhythmias, perforation, valve rupture
 - Electrical shock produces a fall; ventricular fibrillation may also be present

Interventions

First Responder

- Ensure high performance CPR and appropriate ventilation
 - → [PR06: High Performance CPR](#)
 - → [B01: Airway Management](#)
 - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA and BVM

and will not require further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation, and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway) in the management of children during cardiac arrest in the out-of-hospital setting.

- [→ A07: Oxygen and Medication Administration](#)
- Apply AED and follow prompts
- Communicate clinical scenario to follow-on personnel

Emergency Medical Responder – All FR interventions, plus:

- Investigate for precipitating cause
- Ensure scene time is no less than 10 minutes and no greater than 35 minutes
- Contact CliniCall for guidance
- Seek ACP/CCP assistance
- Low mechanism blunt trauma: CPR according to medical guidelines
- Penetrating trauma or high mechanism blunt trauma:
 - Immediately prepare for rapid transport and CPR
 - Control life threatening bleeding while facilitating transport
 - Direct pressure to sites of obvious ongoing blood loss
 - Rapid application of tight [tourniquet](#) for catastrophic extremity injury with ongoing large volume blood loss

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

- Consider vascular access for reversible causes
 - [→ D03: Vascular Access](#)
 - All IV starts on a child < 12 years requires prior pediatric IV training and CliniCall consult

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

- Attach monitor and evaluate rhythm
- Establish vascular access
 - [→ PR12: Intraosseous Cannulation](#)
- Ventricular fibrillation or ventricular tachycardia
 - Defibrillate 2 J/kg, repeat at 4 J/kg
 - [EPINEPHrine](#)
 - [Amiodarone](#)
 - [Lidocaine](#)
- Pulseless electrical activity or asystole:
 - [EPINEPHrine](#)
 - Consider treatable causes
- Bradycardia:
 - Bradycardia with poor cardiac output requires chest compressions if the heart rate is less than 60 and signs of poor perfusion are present. Signs of poor perfusion include cyanosis, mottling, decreased level of consciousness, and lethargy.
 - Consider normal saline bolus 20 mL/kg IV/IO
 - Consider [EPINEPHrine](#)
 - Consider pacing (Requires CliniCall consult)
 - [→ PR19: Transcutaneous Pacing](#)
- Hyperkalemia, Torsades de Pointes, or suspected acidosis:
 - [Sodium bicarbonate](#)
 - Hypoglycemia
 - [→ E01: Hypoglycemia and Hyperglycemia](#)
 - Narcotic overdose:

- [→ J12: Opioids](#)
- Assess for pneumothorax
 - [→ PR21: Needle Thoracentesis](#)

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

- Aggressive fluid replacement including blood products for suspected hemorrhagic shock
- Aggressive re-warming if hypothermia present and suspected to be primary cause of presentation
- Ultrasonography to assess pneumothorax, tamponade and cardiac contractility
- Post-return of spontaneous circulation care:
 - Advanced airway
 - Crystalloid bolus 20 ml/kg IV/IO
 - [EPINEPHrine](#) infusion

Evidence Based Practice

[General Cardiac Arrest Care](#)

[PEA / Asystole](#)

[Post-Cardiac Arrest Care](#)

[VF/VT-Pulseless \(Shock Advised\)](#)

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. Heart & Stroke. 2019 Focused Updates to AHA Guidelines for CPR and ECC: Frequently Asked Questions. 2019. [\[Link\]](#)
3. Tijssen JA, et al. Time on the scene and interventions are associated with improved survival in pediatric out-of-hospital cardiac arrest. 2015. [\[Link\]](#)

M10: Neonatal Respiratory

Wes Bihlmayr

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Reviewed:

Introduction

Respiratory distress in the newborn is defined as an impairment of the lungs to exchange gas at the alveolar level. Multiple pathophysiologic processes can produce respiratory distress in the neonatal period and careful monitoring of the trend of disease progression can assist in identifying the cause.

Paramedic management of the neonate in respiratory distress should focus on maintaining appropriate oxygenation and ventilation based on gestational age and days/hours of life. Differential diagnoses to consider in the just born neonate differ than the differential diagnoses for a neonate on day of life 2 or more.

In neonates the differential diagnoses can be:

- Respiratory distress syndrome (RDS): Primarily a surfactant deficiency that will progressively worsen until 72 hours of life and then slowly get better if no treatment is initiated. Normal in the preterm infant and higher risk of in the neonate born to a mother with poorly controlled diabetes.
- Transient tachypnea of the newborn (TTN): Fluid retention in the lungs that will gradually resolve over 24-72 hours. Common in C-section and precipitous deliveries.
- Congenital pneumonia/sepsis: Similar physical presentation to RDS but with differing radiological evidence and can progress to sepsis quickly if not recognized.
- Pneumothorax: The neonate requires an opening pressure of up to 50 cmH₂O to push out the fluid filling the lung and can cause spontaneous pneumothoraxes.

The term neonate with an uncomplicated antenatal history that develops respiratory complications is unlikely to be RDS, and is most likely to have an infection or undiagnosed congenital problems.

Essentials

- The Neonatal respiratory assessment consists of lung auscultation, evidence of nasal flaring, grunting of the neonate, accessory muscle use (begins in the subcostal and works up the chest as severity increases) and symmetry of the chest. A chest x-ray and blood gas should be performed to gauge severity and initiate a baseline for trend monitoring.
- Establish ABCs and support ventilations if required.
- Support of the neonate's respirations follows staged approach. The FiO₂ is titrated to maintain a preductal SpO₂ of 88-95% in the preterm neonate and 92-95% in the term neonate. Escalation along the respiratory treatment pathway is based on clinical assessment, radiological evidence and blood gas analysis.
- Pre-ductal SpO₂ is performed on the right hand and post-ductal on a lower appendage (right or left foot). A pre-ductal less than 90% or a difference greater than 3% should prompt more investigations.
- Increased work of breathing with associated decreased air entry should be investigated for pneumothorax.

Additional Treatment Information

- Options for supporting neonatal respirations include:
 - Blow by oxygen: titrate to patient's SpO₂ if no increased work of breathing.
 - High flow O₂: 2-3 lpm/kg of heated humidified gas. Titrate FiO₂ to appropriate SpO₂.
 - nCPAP: 5 cmH₂O-8 cmH₂O. Titrate FiO₂ to appropriate SpO₂.
 - Bi-Level Support (non-triggered BiPAP): initial setting of 9/6 (delta P can be as large as 10 mmHg) Ti 0.5-1.0 RR 30. Titrate FiO₂ to appropriate SpO₂.
 - Intubation and mechanical ventilation
- Once a neonate is intubated, bLES should be considered. If the FiO₂ is greater than 30% and there is radiological evidence of surfactant deficiency, bLES is administered (5 ml/kg administered via a 6 fr OG tube down the ET

tube).

- If patient is showing signs of tension pneumothorax – tracheal deviation, increased work of breathing, absent air entry, hemodynamic compromise – needle decompression should be performed while equipment is gathered for a chest tube insertion.
 - In a neonate a 26-gauge butterfly needle attached to a 3 way stop cock and 10 cc syringe is used to access the 2nd intercostal space mid-clavicular line to aspirate air. In an older neonate, a 20 gauge needle connected to a 3-way stop cock and 10 cc syringe may be required
- Due to the rapid progression of sepsis in the neonatal period all neonates with signs of respiratory distress will have a blood culture done and be started on antibiotics: Ampicillin (50 mg/Kg) and Gentamycin
 - Gentamycin:
 - DOL 0-7: < 30 weeks gestation 5 mg/kg
 - 30-34 weeks gestation 4 mg/kg q 36 hrs
 - > 35 weeks gestation 4 mg/kg q 24 hrs
 - DOL > 7: < 30 weeks gestation 5 mg/kg
 - > 30 weeks gestation 4 mg/kg q 24 hours
- Common initial ventilation settings are RR 50 Ti 0.4 TV 4-5.5 ml/kg FiO₂ as required, PEEP 5 cmH₂O. Neonates require I:E ratios approaching 1:1. The normal range of Ti is 0.35-0.5 with most patients requiring 0.35-0.4. If a large tube leak is detected, then PCV ventilation should be considered (starting settings may be 20/5 and then are titrated to effect).
- Neonates require an uncuffed ET tube due to the possibility of subglottic damage from an ET cuff and prolonged intubation, resulting in subglottic stenosis as the neonate grows.
- Sedation in the neonate should only be initiated if there are signs of pain or discomfort based on the BIIP scale as there is evidence of increased morbidity and mortality when sedation is given to neonates with no signs of pain or discomfort. If sedation is to be initiated the preferred analgesics are:
 - Morphine: 50 mcg/kg bolus with an infusion of 10-20 mcg/kg/hr
 - Fentanyl: 1-2 mcg/kg bolus with an infusion of 0.5-2 mcg/kg/hr
 - Midazolam: 50 mcg/kg as a bolus for the labile neonate.
- Maintenance fluids for the first 24 hours should be D10W and after 24 hours D10W with NaCl (20 mmol/L)
 - DOL 0 – 60-80 ml/kg/day
 - DOL 1 – 80-100 ml/kg/day
 - DOL 2 – 100-120 ml/kg/day
 - DOL 3 – 120-140 ml/kg/day
 - DOL 4 – 140-150 ml/kg/day
 - DOL 5 – 150 ml/kg/day

General Information

- Neonates that have been in the community are at an increased risk of an infective origin to their increased work of breathing and need to be considered during the differential diagnosis.
 - Bronchiolitis
 - Pneumonia
 - Croup
 - Pertussis

Interventions

First Responder

- Maintain thermal stability
- Provide supplemental oxygen as required
 - → [A07: Oxygen and Medication Administration](#)
- Manual airway maneuvers
- Positive pressure ventilation via bag-valve mask

- [→ B01: Airway Management](#)

Emergency Medical Responder – All FR interventions, plus:

- Transport to closest facility with notification
- Consider ACP intercept

M03: Pediatrics - Respiratory Emergencies

Wes Bihlmayr

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Reviewed:

Introduction

Respiratory conditions in children can be categorized into upper airway obstructions, lower airway obstructions, lower airway restrictive pathology, and disordered control of breathing.

Upper airway obstructions occur when there is an increased work of breathing due to an obstruction above the thorax. This can consist of a foreign body, tissue swelling, subglottic stenosis from previous intubation trauma, and the development of a tumour. Lower airway obstructions, by contrast, result from obstructive problems below the thorax: foreign bodies, or bronchial swelling or constriction.

Restrictions in the lower airways are a result of "stiffening" of lung tissue, caused by increased fluid accumulation from pulmonary edema, toxic exposure, allergic reactions, infiltration, and inflammation. Abdominal structures can also push on lung tissue, creating a restrictive condition.

Dysfunction within the respiratory center of the brain is responsible for the development of disordered breathing. These are more properly neurological problems with respiratory effects, and can include problems such as increased intracranial pressure, neuromuscular disease, and some poisonings and overdoses.

Essentials

- Upper airway obstruction can be an uncomfortable call to attend as the majority of patients may look ill but require just comfort levels for treatment.
 - See [→ B04: Croup and Epiglottitis](#) for additional information on the management of upper airway obstructions.
- Lower airway obstruction results in an inability for the patient to get air out of the chest. This is usually due to excessive swelling of bronchospasm.
- Lower airway restrictive pathologies consist of numerous conditions that result in decreasing lung compliance or stiffening of the lung. The general management of these conditions concern correcting oxygenation and ventilation utilizing an escalation pathway of increasing FiO₂ via nasal cannula, face mask, heated HiFlow nasal cannula (2 lpm/kg to a max of 60 lpm), NIV therapy and then intubation. Bronchospasm can be treated with a B₂ agonist.
- Disordered Control of Breathing are a series of conditions affecting the respiratory control center in the brain or neuromuscular diseases.

General Information

- Continuous salbutamol can decrease serum potassium
- Ventilating the lower airway restrictive disease patient may require high peak inspired pressure of up to 32 cmH₂O and high PEEP of up to 10-15 cmH₂O. Diligent monitoring for the development of a pneumothorax is required.
- Succinylcholine should be avoided in the patient with neuromuscular disease due to the possibility of triggering hyperkalemia or malignant hyperthermia

Interventions

First Responder

- Prevent heat loss but do not overheat the patient.
- Provide supplemental oxygen as required
 - [→ A07: Oxygen and Medication Administration](#)
- Manual airway maneuvers as required
 - [→ B01: Airway Management](#)

- Positive pressure ventilation with BVM
 - → [B01: Airway Management](#)

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO₂ ≥ 94%
 - → [A07: Oxygen and Medication Administration](#)
- Transport with notification
- Consider ACP intercept

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

- Consider vascular access and fluid administration
 - → [D03: Vascular Access](#)
- Consider supraglottic airway to maintain airway patency
 - → [PR08: Supraglottic Airway](#)
- For bronchospasm, reactive airway disease, and asthma:
 - [Salbutamol](#)
 - Consider intramuscular [EPINEPHrine](#)
 - See → [B03: Asthma and Bronchospasm](#) for additional information.
- For croup, epiglottitis, and stridor:
 - Consider nebulized or intramuscular [EPINEPHrine](#)
 - See → [B04: Croup and Epiglottitis](#) for additional information.

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

- Consider addition of [ipratropium](#) to supplement salbutamol.
- Consider [magnesium sulfate](#) for significant and protracted bronchospasm.
- Consider intraosseous cannulation if peripheral access is unavailable.
 - → [PR12: Intraosseous Cannulation](#)
- Consider procedural sedation to facilitate airway management.
 - → [PR17: Procedural Sedation](#)
- Consider intubation in patients whose airways cannot be managed through less invasive means:
 - → [PR18: Anesthesia Induction](#)
- Decompress suspected tension pneumothorax
 - → [PR21: Needle Thoracentesis](#)

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

- Mechanical ventilation (NIV and invasive)
- Chest tube maintenance
- Osmotic agents
- 3% Saline
- Infusion medication
- Antibiotic therapy
- Steroid therapy
- Nonselective adenosine receptor antagonist and phosphodiesterase inhibitor

References

[Pediatric Wheeze/Bronchospasm](#)

[Pediatric Stridor](#)

