

A07: Oxygen and Medication Administration

Neal Carman and Mike Sugimoto

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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

1. Stub D, et al. Air versus oxygen in ST-segment-elevation myocardial infarction. 2015. [\[Link\]](#)
2. O'Driscoll BR, et al. BTS guideline for oxygen use in adults in healthcare and emergency settings. 2017. [\[Link\]](#)
3. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [\[Link\]](#)
4. Misasi P, et al. Medication safety in emergency medical services: approaching an evidence-based method of verification to reduce errors. 2019. [\[Link\]](#)
5. Abdo WF, et al. Oxygen-induced hypercapnia in COPD: myths and facts. 2012. [\[Link\]](#)
6. Canadian Patient Safety Institute. Patient safety in emergency medical services: Advancing and aligning the culture of patient safety in EMS. 2010. [\[Link\]](#)
7. Ni Y-N, et al. The effect of hyperoxia on mortality in critically ill patients: a systematic review and meta analysis. 2019. [\[Link\]](#)

