Title: OXYGEN ADMINISTRATION
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Authorization
[X] SHR Nursing Practice Committee

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DEFINITIONS:

Arterial Blood Gases (ABG): a requisitioned lab test that measures the amount of O₂, CO₂ and HCO₃ dissolved in plasma. Plasma pH is also measured.

SpO₂: the measurement of functional saturation of oxyhemoglobin. This measurement is obtained non-invasively by pulse oximetry.

FiO₂: the concentration of oxygen in the gas actually being inspired into the lungs and written as a fraction of 1 (e.g. 40% oxygen = 0.40 FiO₂).

Hypoxia: insufficient oxygen available to meet the metabolic needs of tissues and cells.

Hypoxemia: abnormal deficiency of oxygen in arterial blood.

Medical Air: consists of about 21% oxygen, 79% nitrogen (inert) and small amount of other gases.

Lpm: flow rate in litres per minute

1. PURPOSE

1.1 To safely administer oxygen to treat and prevent the symptoms of hypoxia.

2. POLICY

Note: In Home Care and Long Term Care, the private home oxygen company contracted by the client will be responsible for the initiation, monitoring, management & discontinuing of oxygen in the home. Nursing concerns regarding clients’ oxygen needs will be directed to the home oxygen company for follow up.

2.1 Initiation of Oxygen

2.1.1 A practitioner’s order is required to initiate oxygen therapy, except in an emergency situation.
2.1.2 A practitioner's order should include:
• O\textsubscript{2} flow rate or FiO\textsubscript{2} 
or
• Preferably titration of the oxygen flow rate or FiO\textsubscript{2} in order to achieve an acceptable range of SpO\textsubscript{2} values, e.g. 88-92%. In most cases, pulse oximetry is the preferred method of measuring blood oxygen values.

2.1.3 In an emergency situation when a practitioner's order cannot be immediately obtained, oxygen may be temporarily initiated by a Registered Nurse (RN), Registered Psychiatric Nurse (RPN), Licensed Practical Nurse (LPN), Graduate Nurse (GN), Graduate Psychiatric Nurse (GPN), Graduate Licensed Practical Nurse (GLPN), Physiotherapist (PT) or a Registered Respiratory Therapist (RRT) in the presence of any acute situation in which hypoxia is suspected.

2.1.4 A practitioner is to be contacted as soon as possible after initiation of oxygen therapy in emergency situations, for verification and documentation of the order for oxygen therapy consultation, and further orders.

2.1.5 Oxygen delivered by nasal cannula at a rate of 4 Lpm or less will not be routinely humidified for adult patients. All oxygen administered to pediatric patients should be humidified.

2.1.6 Respiratory Therapy Services, if available, is to be consulted when any of the following devices are required: (see Appendix B)
• a large volume nebulizer with FiO\textsubscript{2} greater than 0.50 
• a non-rebreathing mask 
• a high flow high FiO\textsubscript{2} nebulizer (i.e. MistyO\textsubscript{2}®) 
• heated humidified high flow oxygen (i.e. Optiflow®)

2.1.7 Oxygen therapy should be administered continuously unless the need has been shown to be associated with specific situations requiring intermittent use only (e.g. exercise or sleep).

2.1.8 Aerosol generating devices, which include some oxygen delivery devices (i.e. MistyO\textsubscript{2}® and/or large volume nebulizer), should not be used on patients who are known or suspected to have Influenza-Like Illness or Severe Respiratory Illness. Standard bubble humidifiers or heated humidifiers (i.e. Optiflow®), do not produce aerosols.

**Note:** Aerosols can pose a risk of transmission to others.

2.1.9 A portable oxygen cylinder reading 500 psi or less is considered empty and must be replaced. See Appendix A.

### 2.2 Monitoring of Oxygen Therapy

**Note:** Patients requiring an oxygen rate of greater than 50% must be monitored and observed very closely – preferably in an ICU or observation unit. (Exception – palliative or end of life patients receiving oxygen for comfort measures)

2.2.1 SpO\textsubscript{2} will be measured on patients receiving oxygen:
• When the oxygen flow rate or concentration is changed 
• With a change in respiratory status 
• With vital signs (at least every 12 hours) and documented on appropriate patient record.
2.2.2 Patients with a diagnosis of COPD:
- SpO₂ will be measured within two hours of oxygen therapy initiation
- ABG may be ordered by the practitioner within two hours of oxygen therapy initiation

2.3 Infection Control

2.3.1 All oxygen tubings, humidifiers, masks, and standard cannulas used to deliver oxygen are for single patient use only.
- For adult patients change these items only when visibly soiled.
- For pediatric and neonatal patients, change items weekly.

2.3.2 When refilling humidifier bottles, any remaining water will be discarded and the bottle filled with distilled water (See Note below). Bottles will not be “topped-up”.

Note: In acute care, sterile distilled water must be used. In long term care, distilled water may be used.

2.3.3 Large volume nebulizers including MistyOx®, large bore aerosol tubings, and aerosol masks will be changed when visibly soiled and at least weekly.

Note: Aerosolized liquids and related equipment present a particular infection control hazard.

2.3.4 The Optiflow® system produces no aerosol. The heated wire circuit and humidifier chamber are not required to be changed regularly. However, the Optiflow® nasal cannula should be replaced weekly.

2.4 Discontinuation of Oxygen

2.4.1 A practitioner’s order is required to discontinue oxygen therapy.

Note: Criteria for discontinuation of oxygen may include:
- a patient has stable vital signs
- the original disease process has resolved or greatly improved
- the patient is able to maintain SpO₂ values greater than 90% on room air for 24 hours.

2.5 Safe Handling of Oxygen/Equipment

2.5.1 Oxygen vigorously supports combustion. Oxygen therapy equipment must not be used in the presence of open flame. No smoking is allowed in the vicinity of oxygen therapy equipment.

2.5.2 Oils and petroleum products are not to be used around the patient’s face.

2.5.3 Oxygen cylinders are to be secured in a cylinder cart or bracket at all times.

2.5.4 The trans-filling of liquid oxygen into portable liquid oxygen units will only be performed by persons familiar with this procedure.

Note: Liquid oxygen is extremely cold. Exposure to skin will cause frostbite.

2.5.5 Oxygen must not be allowed to flow into the circuit of a BiPAP or CPAP unit that is not turned on. Ensure that the oxygen flow is turned off prior to turning off the BiPAP/CPAP unit.

Note: The oxygen could flow back into the unit’s electrical components causing a fire hazard when unit is turned back on.
3. PROCEDURE

3.1 Assess clinical status of patient, patient history and check the practitioner’s order for oxygen. 

**Note:** In patients with a history of COPD and CO₂ retention, consult with the practitioner prior to initiating oxygen therapy, except in emergency situations.

3.2 Check previous ABG results if there is a history of COPD, to determine if there is CO₂ retention. If there are no previous results documented and the patient has a history of COPD, consult with practitioner about the need for an ABG order if the test is available.

3.3 Explain the procedure to the patient as appropriate.

3.4 Apply a pulse oximeter and obtain a resting SpO₂.

**Note:** In an emergency situation, initiate Oxygen Therapy even if no SpO₂ available.

3.5 Obtain the correct oxygen delivery and humidifier bottle, if required. See Appendix B & C.

3.6 If a humidifier bottle is indicated, fill it with sterile distilled water and ensure all connections are tight and not cross-threaded. See Appendix C.

**Note:** In long term care facilities, the use of distilled or de-ionized water is acceptable

3.7 Connect the device to the oxygen source and set the oxygen flow as prescribed.

**Note:** Ensure the oxygen tubing is connected to an oxygen flow meter sourced from an oxygen outlet. See Appendix D.

**Note:** If medical air is being used for nebulization from the medical air outlet, the flow meter will be clearly marked as medical air. See Appendix E

3.8 Apply the device to the patient.

3.9 Continue to monitor SpO₂. Within 5-10 minutes, blood oxygen levels should equilibrate with alveolar oxygen and the oximeter reading will begin to stabilize.

3.10 If a SpO₂ target is ordered, continue to adjust oxygen flow rate or FiO₂ allowing a 5-10 minute stabilization period between adjustments until desired SpO₂ is achieved. Consider the oxygen device’s flow limitations when adjusting flow rate. See Appendix B for flow limitations.

3.11 Continue to monitor the patient’s vital signs and watch closely for somnolence or confusion and apnea if the patient has a history of COPD or if CO₂ retention is suspected.

3.12 Document on health record:
- Date, time of initiation of oxygen
- Patient assessment
- O₂ flow rate or FiO₂ setting and delivery device(s)
- SpO₂ changes
- Patient’s response
- Patient/family education
4. References


Calgary Health Region: Respiratory Therapy Policies and Procedures

Centers for Disease Control and Prevention (2003) Guidelines for Preventing Health-Care - Associated Pneumonia


Fisher & Paykel product information insert – Optiflow Nasal Cannula rev 2010-05

Related Policies

Respiratory Therapy Policy & Procedure
Portable Oxygen

Intelli-OX™ TRAINING INSTRUCTIONS

Valve instructions

Before connection check
- The bar graph (pressure)  
- The contents gauge (liters)

Connect according to use
- Connect the tube to the nipple outlet
- Or connect the appropriate equipment to the 50 psi DISS connection

Using the cylinder
- Adjust the dial  to the required flow rate if the nipple outlet  is used

After each use
- Turn the cylinder off by setting the flow rate to 0 litre/min (dial )
- Remove the tubing  or the equipment  if necessary

WARNING: If the dial is set between two flow rate values, the flow will stop

IMPORTANT: Refer to EZ-OX Plus™ brochure for further handling, storage & maintenance

Contents Gauge instructions

When the cylinder is not in use
- Pressure is displayed on the bar graph
- Contents are shown in liters

When a change in flow rate is detected, the gauge enters the calculation mode

When the cylinder is in use
- Pressure is displayed on the bar graph
- Remaining time at the set flow rate is displayed in hours:minutes
- Flashing hourglass

NB: Time remaining is updated periodically. Adjust flowrate to force an update. When the flow rate is low or intermittent, the contents display can be unstable, but this does not affect the regulator function

WARNING: The pressure displayed on the bar graph indicates an empty cylinder

Disclaimer: Data shown on gauge is for information purposes only. The user is responsible for ensuring oxygen therapy and oxygen delivery. This product is MR CONDITIONAL (outside the MRi bore).
Oxygen Administration Devices


There are two classifications of O₂ administration devices, low flow (variable FiO₂) devices and high flow devices:

1. **Low flow (variable FiO₂) devices**
   - Oxygen is provided at a certain flow rate in liters per minute. The exact inspired oxygen concentration is unknown and it changes as the patient’s rate and depth of breathing changes. A deeper, faster breath will draw more room air into the lungs. If the O₂ flow rate remains constant, the resulting inspired gas is diluted and its O₂ concentration will decrease.

1.1 **Standard Nasal Cannula**
   - Used at flow rates of up to 6 Lpm. Provides low concentrations of oxygen in the range of 24-40% (actual percentage value is not known). Above rates of 6 Lpm nasal cannulas are less effective and another delivery method should be considered.
   - Nasal irritation is more likely to develop at flow rates above 4 Lpm. Humidification of the oxygen above 4 Lpm may help ease this irritation.
   - Ensure patency of both nasal passages. Mouth breathing is acceptable as long as the nasal passages are clear (Face mask may be more suitable).

**Advantages:**
- Allows patient to eat and converse normally.
- Can reduce anxiety and claustrophobia compared to O₂ masks.

**Disadvantages:**
- A nasal cannula is a low flow device so FiO₂ can fluctuate, e.g. as dyspnea increases respiratory rate and depth may also increase resulting in a decreased FiO₂.

**Pediatrics:**
- Limit the flow rate to 3-4 Lpm and always use a humidifier.

**Neonates:**
- Oxygen can be administered to infants via either low flow or high flow oxygen by nasal cannula. Low-flow regulators are available which typically deliver oxygen at doses between 0.01 Lpm - 1.0 Lpm. Neonates requiring greater than 1.0 Lpm should be assessed carefully and may require high-flow blended oxygen, nasal CPAP or intubation. Please see unit specific policies regarding these procedures.
• Although nasal cannula are considered a low flow system for adults, infants can receive high flow oxygen therapy via nasal cannula because an infant’s inspiratory flow rate is much lower than that of an adult. The flow rate of gas being delivered by the cannula is set at 2 Lpm, which is high enough to provide all of the inspired gas that the infant requires. An air/oxygen blender is used to provide the flow to the cannula at an adjustable concentration, and a known \( \text{FiO}_2 \) is delivered to the patient.

**Neonatal Oxygen Delivery**

**Nasal Cannula for low flow oxygen administration:**

![Image of nasal cannula](image1.png)

- Microdial for 0.01 lpm to 0.1 lpm
- Precision Medical for 0.1 lpm to 1 lpm
Nasal cannula for Blended Oxygen with heated humidity:

Air/Oxygen Blenders with Humidifiers:

Bird blender
Maxtec blender
1.2 Simple Oxygen Mask

- For short term use with flow rates of 5-10 Lpm to provide concentrations of oxygen in the range of 35-50%. Setting the flow rate to less than 5 Lpm may result in rebreathing of exhaled gas from within the mask. Using flow rates greater than 10 Lpm is ineffective at further increasing FiO₂.
- Humidify the oxygen if the simple mask is to be used for more than a few hours and in all pediatric/neonate patients.

**Advantages:**
- Provides higher FiO₂ than nasal cannula.

**Disadvantages:**
- Noisy. Interferes with speaking and eating.
- Patient may feel claustrophobic and anxious which may increase oxygen consumption and requirements.
- Long term use can lead to skin irritation and pressure sores.

1.3 Non-Rebreathing Mask

- Basically a simple mask with the addition of an O₂ reservoir bag and valves. Used when a high concentration of oxygen is needed quickly, usually for a short term. Provides 60-80% oxygen to the patient, depending on the mask fit. Requires a minimum O₂ flow rate of 10 Lpm to prevent rebreathing. Set the flow above this to keep the reservoir bag from collapsing on inspiration.
- Do not use a humidifier with a non-rebreathing mask – condensate in the reservoir bag can affect its ability to expand.
- A High-Ox oxygen mask similar to the non-rebreathing mask may be used in the rare event of an epidemic or pandemic. Respiratory Therapy Services must be consulted for access to this device.
Advantages:
- Quick method of supplying a high FiO₂.

Disadvantages:
- Same as simple mask above.
- Long term use of high concentration, dry oxygen can be very irritating to nasal and oral mucosa.

Pediatrics:
- Use a minimum flow of 5 Lpm to prevent rebreathing of exhaled air from inside the mask.

2. High Flow Devices

- Oxygen is provided at a certain concentration or FiO₂. Inspired oxygen concentration is guaranteed as long as the equipment is set up properly and the patient does not have unusually high inspiratory flow rates. These devices provide a total flow of blended gases (O₂ and air) that is sufficient in most cases to provide all of the inspired gas that a patient requires, regardless of respiratory rate or depth of breathing. If patient inspiratory demand exceeds the output of this device it can no longer be classified as “high flow” and FiO₂ will decrease.

2.1 Air Entrainment Mask (Venti-Mask®)

- Uses various diluter jets to provide precise concentrations of O₂ (24-50%). The minimum flow for a specific FiO₂ is stamped onto the bottom of each diluter jet.
- Usually used for CO₂ retaining COPD patients requiring a specific FiO₂ that will not fluctuate with changes in breathing pattern.
- Do not run the O₂ flow through a humidifier. The diluter jet results in back pressure that may cause the pressure relief valve of the humidifier to “blow off”, decreasing the total flow available for the patient which would result in decreased O₂ delivery.
- Humidity can be supplied in aerosol form via the entrainment ports with the clear plastic humidifier attachment “cup” supplied and a large volume nebulizer attached to an air flow meter. However, air flow meters are not always readily available so this option may not be available.
- The clear plastic humidifier attachment “cup” must be in place even if entrained air is not humidified as it prevents the entrainment ports from becoming blocked.
2.2 Oxygen Therapy via Standard Large Volume Nebulizer Using an Aerosol Mask, Face Tent, or Tracheostomy Mask

- The standard, large volume nebulizer produces an oxygen enriched aerosol that is directed to the administration device (mask, face tent, tracheostomy mask) via large bore corrugated tubing.
- Utilizes an adjustable air entrainment feature to deliver O₂ at 35-100%.
- At settings above 50%, the total flow available for the patient diminishes to the point that this device can no longer be considered a high flow device (the FiO₂ cannot be guaranteed). For FiO₂ settings higher than 0.50 (or 50% O₂) use the Misty-Ox® device (see 2.3).
- The flow of oxygen should be set high enough so the aerosol can be seen exiting the large holes of the face mask even when the patient is inspiring. This indicates that there is no room air dilution at the mouth and the patient is receiving the set FiO₂. Usually this means setting the flow rate as follows:
  - Adults: 8-15 Lpm or “flush” (maximum)
  - Pediatrics: 8-10 Lpm
  - Infants: 5-8 Lpm

![Standard Aerosol Mask](image1)
![Large Volume Nebulizer](image2)
Face Tent and Nebulizer

- Face tents are used for patients with facial trauma or oral/nasal surgery, and may be preferred by patients who become claustrophobic with a regular aerosol mask.
- When using a face tent, set the oxygen flow rate to “flush” (maximum).

Tracheostomy Collar and Nebulizer

- A tracheostomy mask can be used to supply humidity and oxygen to a patient with a tracheostomy. The tracheostomy mask is attached to a large volume nebulizer via large bore corrugated tubing.
- The flow of oxygen should be set high enough so the aerosol can be seen exiting the large holes of the tracheostomy mask even when the patient is inspiring. This indicates that there is no room air dilution at the tracheostomy and the patient is receiving the set \( \text{FiO}_2 \). Usually this means setting the flow rate as follows:

  - Adults: 8-15 Lpm or “flush” (maximum)
  - Pediatrics: 8-10 Lpm
  - Infants: 5-8 Lpm
2.3 **High Flow High FiO₂ Nebulizer (Misty-Ox®)**

- Respiratory Therapy Services is to be consulted for access to this device.
- Patients requiring this amount of oxygen have very serious oxygenation problems and must be monitored very closely, preferably in an ICU or observation unit.

![Aerosol Mask and Misty-Ox® Nebulizer](image)

- These are similar to the standard large volume nebulizer described above but are designed to provide very high total flow output at near 100% oxygen values (the patient is less likely to inhale room air around the mask, therefore oxygen is not diluted).
- Set the flow meter at flush.
- “Tusks” are 6” lengths of corrugated tubing that are sometimes inserted into the holes of an aerosol mask. They increase the effectiveness of the device by increasing the volume of the reservoir the patient has to draw breath from (sometimes called Star Wars).

2.4 **Heated Humidified High Flow Oxygen (Optiflow®)**

- Respiratory Therapy Services is to be consulted for access to this device.
- Patients requiring this amount of oxygen have very serious oxygenation problems and must be monitored very closely, preferably in an ICU or observation unit.
- Usually used in conjunction with a special Optiflow® nasal cannula (below) which come in 3 sizes. It provides very high flow rates of blended gas (up to 100% O₂) to the patient via the nasal passages. Because the gas is heated to body temperature and fully humidified, patient discomfort is minimized.

![Nasal Interface](image)

- This system consists of an air entraining oxygen and flow rate controller (see below), a special circuit and a heated humidifier.
The warm humid gas this device provides makes it ideal for those patients with thick tenacious airway secretions, aiding expectoration and/or airway suctioning.

- Blended gas can also be administered via aerosol mask, face tent, or tracheostomy collar.
- This system can be used for all age groups; however, the size of the nasal cannula prongs will limit its use in small children. These must not create a seal in the nares; excessive airway pressure could occur.

2.5 T-Piece Resuscitators and Oxygen Delivery

The Neopuff Infant Resuscitator is a flow controlled pressure limited mechanical device. When used in conjunction with a blender, the Neopuff can deliver oxygen concentrations of 21-100% through the ETT or via a mask held loosely to the neonate’s face.

When the Neopuff is used with a tightly sealed face mask, positive end-expiratory pressure (PEEP) will also be delivered. Occlusion of the T-piece aperture allows for delivery of positive pressure breaths to the apneic infant.
**Humidifier Bottles**

Oxygen will pick up water vapour if it is bubbled through water in a humidifier bottle. Humidified oxygen does not dry oral/nasal mucosa so is less irritating and theoretically will not cause thickening of secretions. Adults do not usually require a humidifier bottle for flow rates equal to or less than 4 Lpm.

Humidifier bottles are sometimes composed of several parts that require connection (humidifier top and water jar) and attachment to a flow meter and O₂ delivery device. To avoid leaks care must be taken to ensure all connections are tight and not cross-threaded. A leak will result in less O₂ being delivered to the patient.

Pediatrics: pediatric patients receiving oxygen therapy should have a humidifier bottle in-line, except in emergency situations, e.g. manual ventilation.

Do not use a humidifier bottle when using a non-rebreathing mask or air entrainment mask (Venti-Mask®).
Oxygen Flowmeter
Medical Air Flowmeter
Never use medical air for oxygen administration. It is used for nebulization and ventilation but does not deliver therapeutic doses of oxygen.