BREATHE EASIER

An Inter-disciplinary Goal Oriented Approach
to
Oxygen Therapy Administration

Medical Radiation Technologists

TABLE OF CONTENTS

ALL MEDICAL RADIATION AND SONOGRAPHERS STAFF AT LHSC ARE EXPECTED TO DEMONSTRATE THE FOLLOWING:

- Describe the physiology of oxygen transport.
- Assess adequacy of oxygenation.
- Understand that oxygen is a drug and requires a physician's order.
- Define goal oriented oxygen therapy.
- Ensure uninterrupted oxygen therapy during patient transport, procedures and /or activity.
- Initiate oxygen therapy and demonstrate correct equipment set-ups.
- Identify adequacy of oxygen tank volumes and recognize the relationship between the dose /flow rate of oxygen therapy and the rate of tank depletion.
- Identify the roles of the various members of the health care team related to oxygen therapy and pulse oximetry monitoring.
- Communicate relevant information related to oxygen therapy to appropriate members of the team.
- Document relevant information related to oxygen therapy.
- Respond appropriately to a decrease in oxygen saturation.
-

WHY DOES THE BODY NEED OXYGEN?

Oxygen is necessary to complete the metabolism of glucose (fuel) and make energy or ATP. Every function in the body requires energy and therefore oxygen. If less oxygen reaches the cells of the body than the cells require, normal functions of the body will be adversely affected.

The following are some examples of how inadequate amounts of oxygen can affect the body:

- Alterations in brain function
- Alteration in the ability of the heart to pump adequately
- Reduced ability of the diaphragm muscle to work
- Alteration in the ability to digest /absorb food
- Alteration in kidney function
- Fatigue or generalized muscle weakness

Remember!!! If oxygen deficiency lasts long enough, permanent organ injury or death may result.

HOW IS OXYGEN DELIVERED TO THE CELLS OF THE BODY?

Getting enough oxygen to the cells of the body requires four (4) distinctly different activities:

- The lungs must be able to take in enough oxygen (adequate ventilation)
- There must be enough hemoglobin (Hb) to carry oxygen from the lungs to the cells
- The heart must be able to pump enough blood (adequate cardiac output)
- The cells of the body must be able to remove the oxygen from the blood stream (extraction)

WHAT ARE EXAMPLES OF PROBLEMS THAT CAN PREVENT THE BODY CELLS FROM RECEIVING ENOUGH OXYGEN?

Respiratory Problems - Problems with the respiratory system can prevent the body from taking in enough oxygen. Some examples of these problems include:

- Post anesthesia
- Chronic lung conditions
- Congestive heart failure /pulmonary edema (fluid in the lungs)
- Pneumonia Pneumothorax /tension pneumothorax
- Airway diseases such as asthma
- Malignancies of the lung
- Flail chest /rib fractures
- Pulmonary embolus
- Excessive sedation

Cardiovascular Problems - Inadequate cardiac function reduces the movement of blood from the lungs to the cells and therefore decreases the delivery of oxygen. Some examples of cardiac conditions that impact delivery of oxygen to the body's cells include:

- Angina
- Congestive heart failure /pulmonary edema
- Inadequate fluid volume /dehydration
- Myocardial infarction
- Some abnormal cardiac rhythms
- Congenital heart defects
- Pulmonary embolus
- Tension pneumothorax

Hemoglobin Problems - Decreased hemoglobin reduces the number of “vehicles” available to carry oxygen from the lungs to the cells. Regardless of how well our lungs and heart work, without hemoglobin, oxygen will not reach the cells of the body. Examples of illnesses that may cause low or abnormal hemoglobin and therefore reduce cell oxygen delivery include:

- Hemorrhage
- Malnourishment /dietary deficiency anemias
- B12 deficiency (pernicious anemia)
- Sickle cell anemia
- Renal failure (chronic anemia)
- Liver failure (chronic protein deficiency)

***REMEMBER:** If hemoglobin level is low, the patient may have "normal" value of SpO_2 but may not be adequately oxygenated

Cellular Problems - Inability of the cells of the body to use oxygen is a less common situation. It often occurs in combination with other problems. Some examples of situations that may interfere with the ability of the cells to use oxygen include:

- Cyanide poisoning (one of the toxins often associated with smoke inhalation)
- Carbon monoxide poisoning
- Severe edema
- Septic shock

WILL OXYGEN THERAPY ALWAYS IMPROVE PROBLEMS WITH OXYGEN DELIVERY?

Anemia and /or dehydration are two examples where the body is unable to deliver enough oxygen to the tissues even though the concentration of oxygen is normal. If oxygen concentrations are normal, oxygen therapy will not improve the oxygen delivery problem.

Oxygen therapy alone will only improve oxygen delivery if there is a decreased concentration of oxygen in the blood. The only way to know whether a patient has an inadequate concentration of oxygen in the blood is to measure either a blood gas sample or pulse oximetry reading (oxygen saturation). Oxygen therapy should be ordered because the clinical condition, blood gases or oxygen saturations indicate that it is needed.

If a patient should suddenly deteriorate, it is very appropriate to initiate oxygen immediately in case the patient has a reduced oxygen concentration. This should be confirmed as soon as possible by a blood gas or pulse oximetry reading. The physician and respiratory therapist must be notified immediately for proper follow-up. Extreme caution should be taken when administering oxygen to patients with chronic lung disease and certain neuromyopathies (e.g., ALS (amyotrophic lateral sclerosis)).

WHAT ARE THE SIGNS AND SYMPTOMS OF SOMEONE WHO IS TRYING TO INCREASE THE AMOUNT OF OXYGEN TO THE CELLS OF THE BODY?

Regardless of the cause of inadequate delivery of oxygen to the cells of the body, the body will attempt to compensate by stimulating increased breathing and cardiac output. An individual who is attempting to compensate for a problem getting oxygen to the cells may therefore display any of the following symptoms:

- **Respiratory Signs and Symptoms**
  - Rapid and deep or shallow breathing
  - Difficulty breathing, shortness of breath
  - Noisy breathing, wheezes or crackles
  - Panic feeling or sense of air hunger

- **Cardiovascular Signs and Symptoms**
  - Rapid and bounding or weak pulse rate
  - Hypotension or hypertension

WHAT SIGNS AND SYMPTOMS INDICATE THAT THE COMPENSATION IS NOT WORKING AND THE PATIENT IS GETTING INTO SEVERE DIFFICULTY?

When stimulation of the cardio-respiratory systems fails to adequately increase oxygen delivery, the signs and symptoms seen are related to oxygen deprivation to the cells.

Signs and symptoms of critical oxygen deficiency include:

- **Alterations in cerebral oxygenation:**
  - Confusion, combativeness, restlessness
  - A feeling of impending doom
  - Decreased level of consciousness

- **Alteration in tissue perfusion:**
  - Decreased blood pressure and /or pulse strength
  - Cool, cyanotic or pale skin
  - Diaphoresis
  - Decreased capillary refill

HOW DOES ACTIVITY AFFECT OXYGENATION?

Anything that increases the body's rate of metabolism will increase the amount of oxygen the cells need, increase the amount of carbon dioxide the lungs will be required to exhale, and increase the workload of the respiratory muscles and heart.

Remember that a patient whose oxygenation or cardio-respiratory status is stable at rest may suddenly get into difficulty by a minor increase in metabolic rate. Metabolic rate will increase with pain, fever, anxiety, activity such as eating or ambulation, and transfers from a bed to a stretcher.

If a patient needs oxygen at rest, they will definitely need their oxygen therapy with increased effort or activity.

Oxygen therapy when ordered must be uninterrupted!

Patients stable at rest may suddenly get into difficulty with even minor activity

WHAT IS PULSE OXIMETRY?

Pulse oximetry or SpO_2 measures the oxygen saturation of arterial blood by a non-invasive technique. Pulse oximetry sends an infrared light beam into blood vessels on a finger, toe or earlobe. The oximeter can identify the percentage of oxygen that is bound to hemoglobin (SpO_2) by analysis of the light beams. Since pulse oximetry must detect a pulsatile blood flow, anything that interferes with the ability to "see" the blood vessel can interfere with accuracy. Pulse oximetry is an excellent screening device or guide to oxygen therapy.

As with all technology, one needs to remember that certain factors can interfere with accuracy and be aware of the need to confirm results with blood gases. An accurate pulse oximetry reading will display a clear waveform (if available) for every beat of the heart and display a pulse rate equal to the patient's heart rate. Pulse oximeters provide an opportunity for deviations from a patient's oxygen baseline to be noticed immediately. It provides an early warning signal to clinicians to help prevent the consequences of desaturation and detect hypoxemia before it produces cyanosis.

Pulse oximeters do have accuracy limitations, which must be clearly understood to ensure they are used most effectively. Standard pulse oximeters do not offer information about hemoglobin concentration, cardiac output, efficiency of oxygen delivery to the tissues, oxygen consumption, or adequacy of ventilation and oxygenation.

Examples where pulse oximetry may not be accurate include:

- Low blood flow states (e.g., hypotension, early shock, hypovolemia, unstable hemodynamic states, severe or rapid desaturation)
- Some nail polishes
- Severe edema
- Certain poisons including carbon monoxide and smoke inhalation (may read falsely high)
- Significant levels of dysfunctional hemoglobin (carboxyhemoglobin, methemoglobin)
- Profound cyanosis
- Jaundice and darker skin pigmentation
- Use of vasoactive drugs
- Light interference (fluorescent)
- Motion
- Venous pulsation by blood pressure cuffs
- Probe too tight; tourniquets, air splints, blood pressure cuffs

Remember, a normal pulse oximetry reading is 95-100%. An acceptable value for therapy is 92%. This is different than the range for PaO_2. Normal and acceptable values may be lower for special populations like neonates and paediatric patients as per unit standards and orders.

WHO NEEDS PULSE OXIMETRY MONITORING?

Continuous monitoring may be indicated but not limited to the following:

1. Upper airway issues: tracheostomy patients, sleeping non-tracheostomy patients with upper airway problems (e.g., airway tumours), patients unable to maintain their airways during specific episodes (e.g., Upper Respiratory Infection, seizures), patients who have undergone upper airway surgery.
2. Apnea - actual or high probability: patients with sleep apnea, patients with any condition that is known to cause apneic episodes (e.g., obesity, prematurity).
3. Hypoventilation: patients with a disease, injury or surgical intervention contributing to compromised chest wall movement (e.g., neuromuscular disorder or major abdominal / thoracic surgery).
4. Hypoxia: patients with a disease process that may contribute to decreased oxygen delivery (e.g., past or current cardiopulmonary disorders, lung diseases (e.g., COPD severe enough to cause at least one episode of documented desaturation treated with oxygen)).
5. Sedation /Analgesia: during a therapeutic intervention likely to produce hypoxemia (e.g., placement of central lines, bronchoscopy, endoscopy, cardiac catheterization, joint manipulation), during and post procedural sedation until patient is fully awake.
6. Patients receiving mechanical ventilation. This includes invasive (intubated) and non-invasive ventilation (BIPAP), unless otherwise ordered.

Intermittent monitoring:

1. Patients on oxygen therapy.
2. Patients at risk for hypoxemia, patients who are sedated, receiving certain analgesics (e.g., PCA, epidural analgesia), have fluctuating oxygenation or high FiO_2.
3. Patients with respiratory illnesses, especially those requiring oxygen therapy and if applicable and appropriate those with COPD, asthma, post-operative recover from surgery or congenital heart disease.
4. Other conditions as ordered by the physician.

WHO INITIATES PULSE OXIMETRY MONITORING?

RN, RPN, RRT, MD, NP /CNS would use pulse oximetry equipment as required for intermittent assessment. For frequent pulse oximetry assessment the MD would provide appropriate patient care orders either directly or through order care sets or medical directives for specific patient populations.

MEASUREMENT TECHNIQUES AND EQUIPMENT USED FOR PULSE OXIMETRY

All devices used to measure pulse oximetry require routine calibration checks to ensure accuracy as part of a regular preventative maintenance program.

Pulse oximetry can effectively warn of dangerous levels of oxygen saturation and changes in pulse rate. It does not offer information regarding adequacy of ventilation. Oximeters may be used for intermittent assessments or a series of continuous measurements. Trends are more important than absolute figures. An accurate pulse oximetry reading will display a clear waveform (if available) for every beat of the heart and display a pulse rate equal to the patient's heart rate. (see Figure 1)

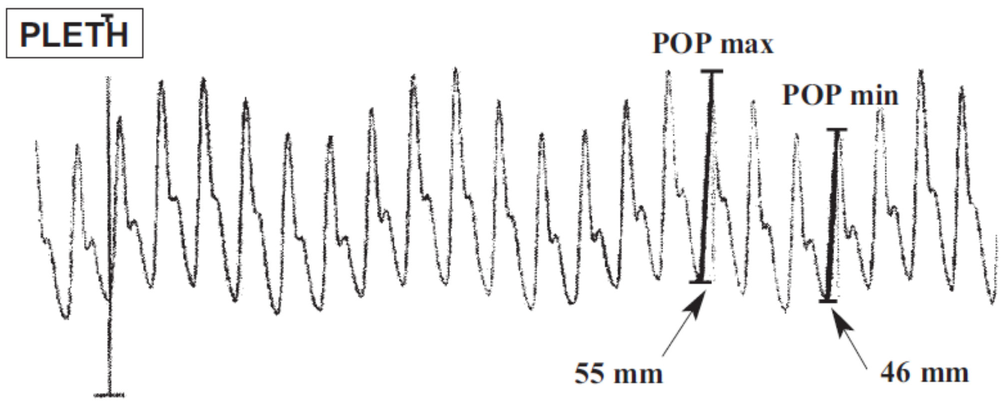


Figure 1. Pulse Oximetry Waveform

Steps for Pulse Oximetry Measurement:

1. Place the probe on any one of the client's fingers or appropriate site with the light beam on a pulsing vascular bed.
2. Ensure the monitor is turned on and alarm parameters are set and audible.
3. Instruct the patient /substitute decision maker to keep the probe in place.
4. Educate the patient the reason for pulse oximetry monitoring.
5. If malfunction is suspected, first check the status of the patient to be sure that it is not a patient emergency causing the unexpected readings.
6. Verify equipment integrity after checking the patient.

TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSES	ACTION
Inaccurate readings	Since pulse oximetry must detect a pulsatile blood flow, anything that interferes with the ability to "see" the blood vessel can interfere with accuracy examples include: • nail polish • cold extremities • severe edema • dark skin pigmentation • light interference • fluorescent • motion • venous pulsation by • blood pressure cuffs • probe too tight • tourniquets, air splints	• Place the probe on another area such as the opposite hand, toes or ear • Turn off overhead lights • Ask patient to remain still • Switch hands • Loosen
Oximetry waveform is not clear	• Placement of probe • Probe is dysfunctional • ↓ Blood Pressure • Cold Extremities	• Change probe site and/or ensure probe is securely in place • Change probe • Change probe site • Assess need to treat • ↓ Blood Pressure • Attempt to warm, change probe site

WHAT SHOULD I KNOW ABOUT COPD PATIENTS, "CO_2 RETAINERS" (secondary to COPD, ALS or neuromuscular disease)?

Normally, we all breathe because our blood carbon dioxide level ($PaCO_2$) rises. The only time that oxygen levels would stimulate breathing in normal individuals would be if blood oxygen concentrations (PaO_2) fell to an abnormally low level. This oxygen stimulus acts as a "back-up" system. In COPD patients or those with chronically elevated carbon dioxide levels ($PaCO_2$), their stimulus to breathe changes from that of a normal patient.

As a result of a chronic elevation to their CO_2 levels, they require higher CO_2 levels before they increase their rate of breathing. For 10-20% of COPD patients who do develop these abnormal changes in their stimulus to breathe, it is important to realize that caution must always be exercised when administering oxygen to this group of patients. If too much oxygen is administered to this group of patients, they may lose their "hypoxemic" stimulus that makes them breathe and they can have a respiratory arrest.

Before administering oxygen therapy, it is always important to know whether the patient may be a CO_2 retainer. If they do have this problem, they may still develop situations where they need supplemental oxygen. The goal for these patients however, would be to raise their blood oxygen concentrations only to a PaO_2 of approximately 50-60 mmHg, or an oxygen saturation of 88% - 92%. They chronically maintain a high serum bicarbonate (or positive base excess) on their blood gases to compensate for their elevated $PaCO_2$ and keep their pH normal. Expect high $PaCO_2$ and bicarbonate levels on their normal blood gases; if their pH is out of the normal range, this is abnormal.

Also remember, these patients may stop breathing if their oxygen concentration becomes too high. Sedatives such as Valium, Ativan and narcotics, such as Morphine can depress their respiratory centre. If they need oxygen therapy, their oxygen therapy goal will be to achieve a lower saturation than a normal patient.

These patients have a chronically elevated CO_2 with a normal pH. A change in their pH means that they are no longer stabilized. In ALS and some neuromuscular diseases, the diaphragm and intercostal muscles become weak and over time this leads to an increased $PaCO_2$ or hypercapnea. Oxygen must be used very carefully with these patients as using oxygen above 1 or 2 lpm may further increase the $PaCO_2$ and lead to respiratory failure. A physician's order is required if oxygen is used in this population and oxygen should not be titrated above 1 or 2 lpm without further assessment by the Neurology or Respirology physicians unless it is an emergency situation where respiratory failure is imminent. In case of emergency, contact the RRT and / or CCOT / PCCOT.

WHAT IS GOAL ORIENTED THERAPY?

Goal oriented therapy is defined as therapy that is provided with a clearly defined purpose or goal. Goal oriented oxygen therapy is the administration of oxygen to a desired outcome of achieving adequate blood oxygen concentrations and absence of clinical distress. In goal oriented therapy, oxygen must be frequently reassessed to ensure that the concentration of oxygen being used matches the patient's current oxygen requirements.

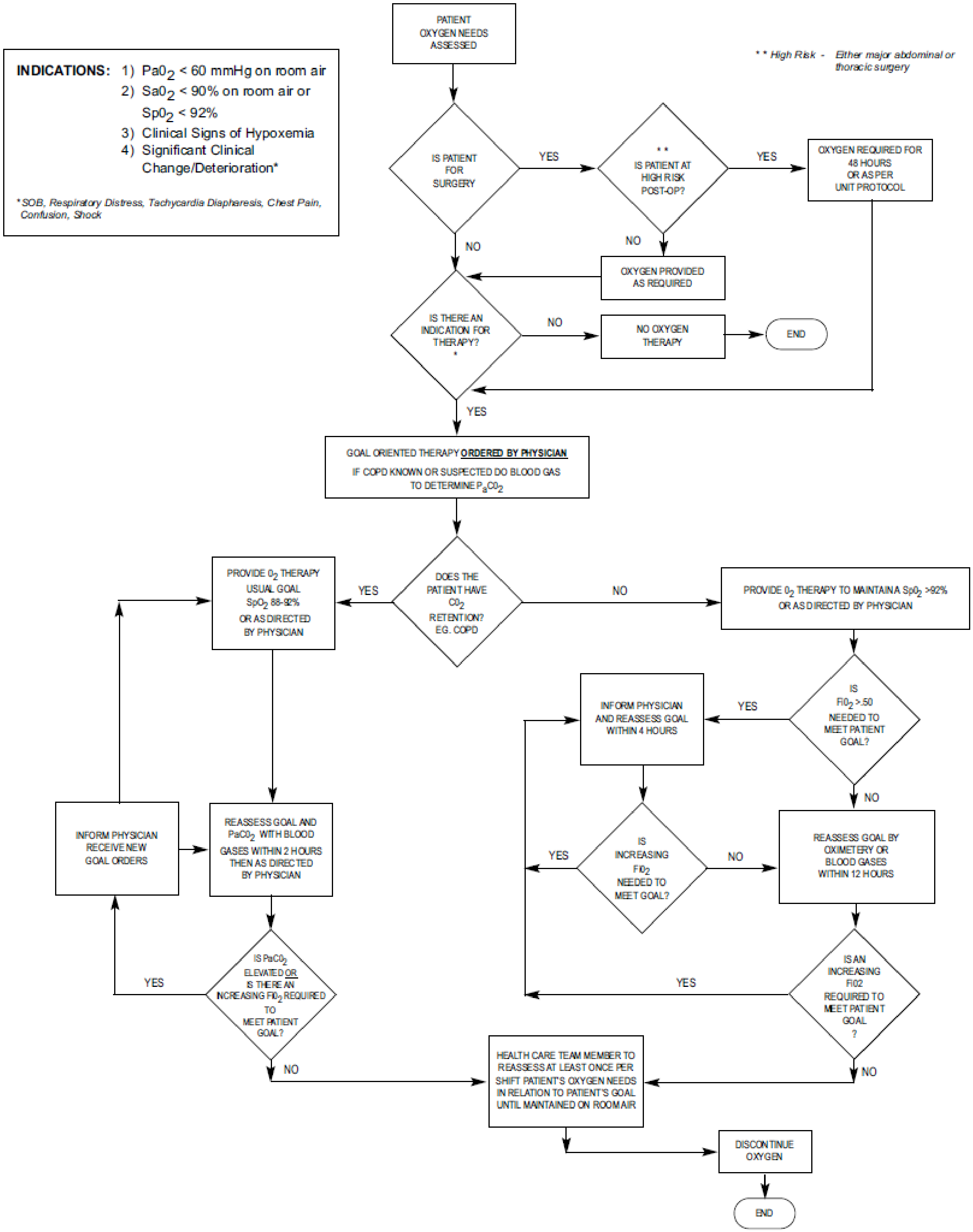
Goal oriented therapy reduces the likelihood of administering lower doses of oxygen than a patient needs, and decreases the chance that oxygen will be used when it is not required. Uninterrupted delivery of oxygen means that it must be continued during transport off the unit, and during ambulation. This includes trips to the bathroom or while sitting up in a chair.

In goal oriented therapy, oxygen should only be used when clinically indicated. Consequently, anyone who has oxygen ordered must receive the therapy without interruption. To provide goal oriented therapy, a flowchart was developed for adult patients and one for paediatrics, to assist caregivers to determine the appropriateness of oxygen therapy. These flow charts are shown on the following pages.

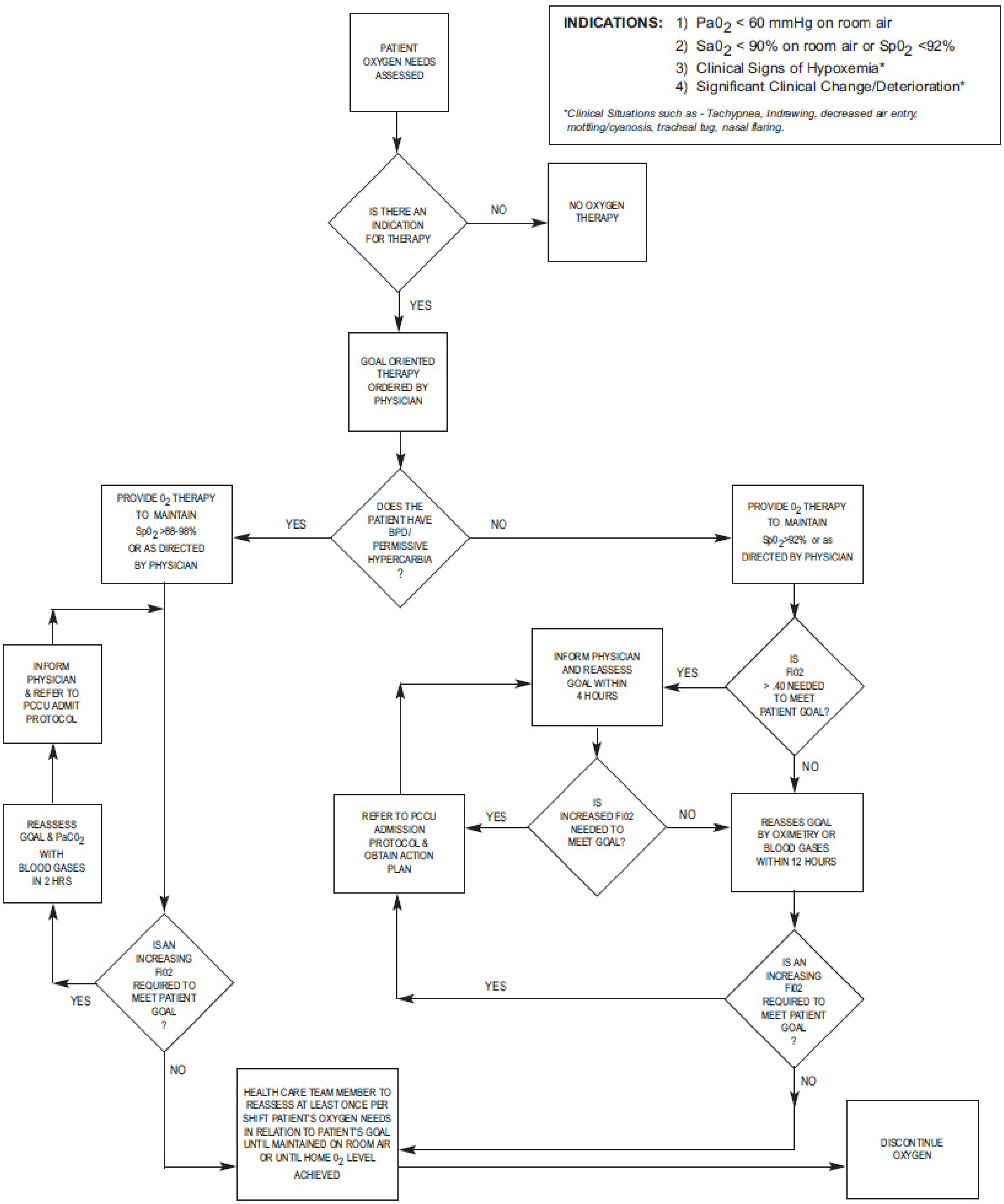
See Appendix A - Adult Guidelines for Goal Oriented Oxygen Therapy

See Appendix B - Paediatric Guidelines for Oxygen Therapy

GUIDELINES FOR ADULT GOAL ORIENTED OXYGEN THERAPY



GUIDELINES FOR PAEDIATRIC OXYGEN THERAPY



WHEN IS IT APPROPRIATE TO USE OXYGEN?

Oxygen therapy is given to increase blood oxygen concentrations. Appropriate situations for oxygen therapy include documented hypoxemia, and the treatment of documented hypoxemia (a lower than normal PaO_2, SaO_2, or SpO_2).

Oxygen therapy can also provide a "safety net" for patients whose oxygen concentrations may fluctuate (e.g., pulmonary embolus, mucous plugging or secretions).

For patients with a documented relative hypoxemia, a "relative hypoxemia" is defined as a PaO_2 lower than normal for a patient's age, at the same time as blood gases show a respiratory alkalosis (hypoxemic relative to the amount of breathing being done). A "relative hypoxemia" suggests that although the patient is able to maintain an adequate (or borderline) oxygen concentration, they should have a better oxygen concentration given the amount of "overbreathing" being done. Remember, we normally breathe in response to an increase in our CO_2, we do not normally breathe so much that we make our CO_2 lower than normal. If we breathe so much that our CO_2 is lower than normal, our oxygen concentration should be well within the normal range. A patient who has a low normal PaO_2 while on supplemental oxygen has a "relative hypoxemia"; they are hypoxemic compared to the amount of oxygen they are receiving. It is important to interpret oxygenation in light of the amount of oxygen therapy being administered (a PaO_2 of 70 mmHg may normally be fine but would be quite concerning if the patient was on 100% oxygen).

It is also appropriate to order oxygen therapy if there is clinical evidence to support its use. Examples of appropriate clinical situations include:

- To decrease the work of breathing for patients having to breathe very hard to maintain their blood oxygen concentrations (respiratory distress).
- To decrease the work of the heart if the heart is having to work very hard to compensate for a problem oxygenating the blood (cardiovascular symptoms)
    - Oxygen therapy should only be used if there is evidence that it is beneficial. Oxygen can be harmful if used too long or at higher levels than necessary.
    - In acute situations where a patient suddenly becomes distressed and displays cardio-respiratory symptoms, **oxygen should be started immediately**, while the cause is investigated simultaneously.
    - If oxygen therapy is used, blood oxygen concentrations need to be measured to assess oxygenation accurately.
    - Remember that although it may be detrimental to use oxygen for prolonged periods when it is not indicated, this concern **should never prevent or delay initiation of oxygen in acute situations** where there is either hypoxemia or clinical indications for its use.

WHAT ARE THE MOST IMPORTANT THINGS TO REMEMBER ABOUT GOAL ORIENTED THERAPY?

- Oxygen should not be ordered unless there is clinical evidence to support its use.
- Oxygen should only be used when indicated and discontinued when not required.
- The rationale for using oxygen must be documented.
- Oxygen therapy delivery must be uninterrupted. This includes transport off the unit, ambulation to the bathroom or sitting up in a chair.
- Blood oxygen concentrations are the only way to assess whether oxygen therapy is truly indicated.
- Regular assessments (q shift and more regularly depending on the patients' clinical condition) by the nurse of the appropriateness of oxygen therapy must be made and documented.
- Oxygen therapy will be discontinued when the patient meets the room air goal or home oxygen setting, according to the protocol.

Only patients who need oxygen should be ordered oxygen. If a patient does not need their oxygen, they should not have an order for it! For example, a patient receiving oxygen therapy must receive uninterrupted oxygen when getting up to the bathroom. Obtaining extension tubing, a commode or bedpan is a more appropriate solution when a portable tank is not readily accessible!

HOW DO I SET-UP OXYGEN EQUIPMENT?

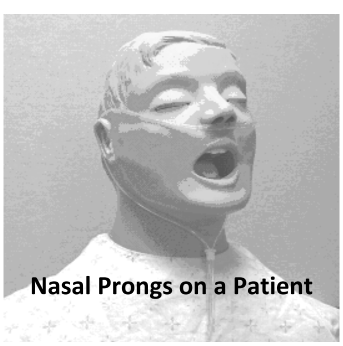
Equipment

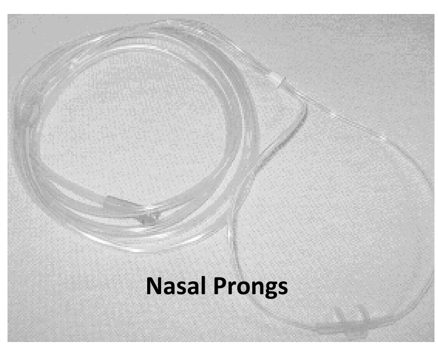
- Oxygen from tanks or wall units is a dry gas. Moisture may be added to keep secretions from drying and facilitate airway clearance.
- Always verify that flow is present prior to placing the mask or prongs onto the patient.
- Moisture:
  - For oxygen therapy via nasal prongs < = 4 lpm, NO humidity is indicated.
  - For oxygen therapy via venti-mask, no humidity is indicated.
  - When indicated, two types of moisture adding devices are used.
  - Humidity may be indicated on paediatric patients at all flow rates.
  - Bubble Bottles (Humidifiers):
    - Adds water you can't see.
    - The warmer the air, the more water it holds.
- Large volume nebulizers:
  - Adds particulate water to humidified air in the form of a visible mist (maximum moisture).
  - Used with aerosol masks, trach masks and face tents to 100% humidification.

Note: Delivery of oxygen via a large volume nebulizer is a considered an aerosol generating medical procedure when the oxygen concentration exceeds 50%. Refer to LHSC's Routine Practices Policy, Appendix A (Routine Practices for Respiratory Procedures that Generate Droplets/Aerosols).

Low Flow Delivery:

- **Nasal Prongs:**
  - Delivery of oxygen by nasal prongs inserted in nares.
  - Less effective if patient is mouth breathing, has a respiratory rate 25 bpm, or requires > 35%.
  - Maximum flow rate delivered should be 5 litres per minutes. Please note that some patients will be prescribed higher flow settings at home.
  - Can only set flow rate at liters per minute and not absolute oxygen concentration.
  - Concentration delivered depends on breathing rate and pattern, maximum concentration is likely 35%.
  - At flow rates < = 4 lpm humidity is NOT indicated.
  - The cannula tips should be in the nostrils, following the natural contour.
  - Tubing should be draped over ears and pulled snuggly over the chin.


Nasal Prongs on a Patient


Nasal Prongs

High Flow Delivery:

- **Venti-masks:** use with flowmeter and nipple connector
  - Recognized by color-coded interchangeable connectors.
  - Choose the coloured connector that corresponds to the desired concentration of oxygen.
  - Turn the flow-meter to the flow rate imprinted on the bottom of the coloured connector.
  - Humidity is NOT indicated.

% Concentration (what we chart)	Colour Code	Set O2 flow
24	Blue	2 lpm
28	Yellow	4 lpm
31	White	6 lpm
35	Green	8 lpm
40	Pink	8 lpm
50	Orange	12 lpm

Venti-mask on patient

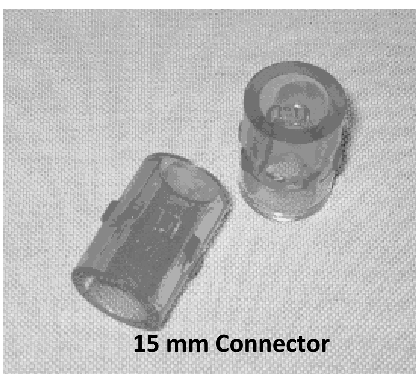
Venti-mask

Face Tents:

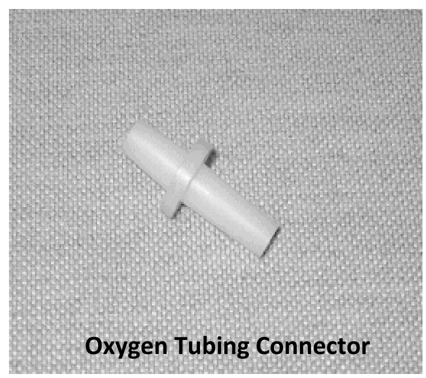
- Rests under chin and cups around the face but doesn't rest on nose (appropriate for facial burns or ENT patients).
- May be used for patients who cannot tolerate a face mask (e.g., claustrophobia).
- Due to loose fit, oxygen concentration cannot be guaranteed.

Extension Tubing:

- May be added to reach the bathroom or chair.
- For nasal prongs and venti-mask, oxygen tubing and an oxygen tubing connector are used.
- For aerosol masks and trach mask, corrugated tubing and a 15 mm connector are used to attach tubing.
- Do not adjust flow rate if tubing is added.
- Be aware of increased risk for disconnection or kinking of tubing.

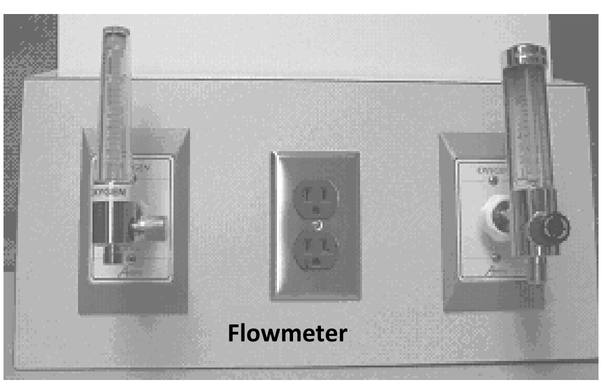


15 mm Connector



Oxygen Tubing Connector

Oxygen nipple connector for flowmeter without humidification system.



Flowmeter

Oxygen nipple connector for flowmeter Without humidification system

HOW DO I SET-UP OXYGEN?

For cylinders or tanks (refer to following diagram):

1. Check the order to identify targeted SpO_2 and select equipment needed to achieve target e.g., nasal prongs, venti-mask.
2. Attach oxygen supply line for cannula/mask to tank.
3. Assure the flow control is "off" on flowmeter.
4. Open main cylinder valve by turning counterclockwise.
5. For nasal prongs, adjust litre flow to achieve SpO_2 goal.
6. For venti-mask, adjust to the recommended flow rate as indicated on the colored connector.
7. For aerosol mask, set flow rate at 8-12 litres per min.
8. For high flow nebulizer (identified by green top: set-up by RRTs only) patient must be switched to a non-rebreathing mask for transport.
9. Open flow control to desired amount in litres per minute by turning clockwise.
10. Fit cannula /mask to patient.

TO DISCONTINUE OXYGEN:

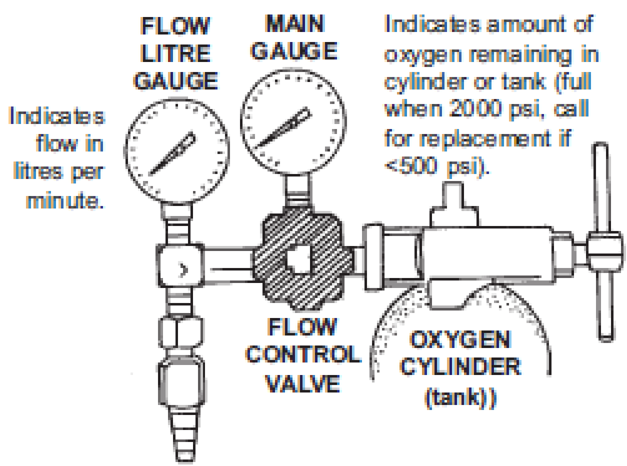
- Turn off the cylinder by turning main valve clockwise, turn flow control clockwise until flow is stopped.
- Arrange for replacement tank when main valve reads 500 psi or less. (Call sooner if higher flows are needed.)
- Oxygen cylinders must be transported in an approved cylinder carrier only. They must not be left freestanding or be transported in any device not intended for the transport of cylinders.

HOW DO I SET-UP OXYGEN?

Important Note

- The higher the flow rate, the shorter the time period before the oxygen tank will run dry.
- For example, if an oxygen device requires 10 litres/minute flow, a full "E" size tank (2200 psi) will last 60 minutes. At 500 psi, only 15 minutes worth of oxygen remains in the tank at 10 litres/minute.
- Refer to the tank content guide on the portable tank for approximate time remaining at various flow rates.

Oxygen Cylinder Duration (Estimates only for an "E" size cylinder)				
FLOW (litres/min.)	VOLUME (PSI)			
	500	1000	1500	2000
2	1.5 hrs.	3 hrs.	4.5 hrs.	6 hrs.
4	45 mins.	90 mins.	2 hrs.	3 hrs.
8	30 mins.	45 mins.	75 mins.	90 mins.
12	15 mins	30 mins.	45 mins.	60 mins.
15	11 mins.	22 mins.	33 mins.	45 mins.



For Wall Oxygen:

1. Check the order to identify targeted SpO_2 and select equipment needed to achieve target e.g., nasal prongs, venti-mask.
2. Attach flow meter with a nipple to wall oxygen outlet.
3. Attach oxygen supply line for prongs/mask to nipple on flowmeter.
   - Open flow control to desired flow in litres per minute.
   - For **nasal prongs**, adjust litre flow to achieve SpO_2 goal.
   - For **venti-mask**, adjust to the recommended flow rate as indicated on the colored connector.
   - For **aerosol mask**, set flow rate at 8-12 litres per min.
   - For **high flow nebulizer** (identified by green top: set-up by RRTs only) must be set at greater than 15 litres /minute.
4. Fit prongs /mask to patient.

For Wall MEDICAL AIR:

1. If medical air is required, contact RRT.
2. Medical air flowmeters are not to be placed in any wall outlet unless specifically required and must be removed when no longer needed. This decreases the chance of any confusion between an air and oxygen flowmeter.
3. Medical air flowmeters are clearly marked to identify them as such.

NOTE: If humidity is required, contact the Respiratory Therapist to discuss clinical need and provide appropriate equipment. Delivery of an aerosol is a **high risk procedure**.

Refer LHSC Routine Practice Policy

HOW DO I KNOW WHICH OXYGEN SET-UP TO USE?

Nasal Prongs:

- Use for patients who are breathing through their nose with comfortable breathing patterns.

Venti-mask:

- Use when oxygen concentration is 24-50%.
- Use when it is not anticipated that patient will require > 50% oxygen, or when humidification needs are not excessive.

Aerosol Mask:

- Use if patient is on 50% or greater, or it is anticipated that oxygen requirements may increase.
- Use when higher humidification requirements are needed.
- Requires assessment by RRT if > 50% to determine if a high flow nebulizer (green top) is required.

HOW DO I KNOW IF OXYGEN IS SET-UP CORRECTLY?

First:

- **Read the Gauge closest to the Oxygen Tank or Cylinder:**
  - Ensure main cylinder on portable tank is open (turned counterclockwise).
  - If the tank reads < 500psi, do not transport with that tank. Arrange for a replacement tank.

Note: If the oxygen flow rate is 10 liters /minute, 500 psi will only last 15 minutes. If flow rates are higher, the tank will empty even sooner. This is particularly important for patients receiving greater than 50%, which requires higher flow rates to deliver.

Second:

- **Check that the correct oxygen concentration is set.**
  - For **nasal prongs**, turn flow to concentration needed to achieve SpO_2 target.
  - For **venti-mask**, turn flow rate at the amount indicated on the colored connector, colored connector indicates percentage O_2.
  - For **aerosol mask**, set flow rate at 8-12 lpm.
  - For **high flow nebulizer** (identified by green top: set-up by RRTs only) must be set at greater than 15 lpm.

WHAT IS THE PROTOCOL RELATED TO TRANSPORT?

- **Specific paediatric considerations are on the next page**

  Assess whether the patient is unstable **or has** > .5 FiO_2.

  - If yes to either, physician /nurse /RRT to review need for a team member to accompany patient.
  - A Respiratory Therapist must be called for patients requiring > .50% O_2 to ensure that the oxygen is delivered and hooked up properly.
  - **Patients with fluctuating neurological, respiratory or cardiovascular status must be accompanied by a Nurse or physician.**
  - If staffing issues limit availability of Nurse/RRT, discuss concern with physician to negotiate appropriate solution (e.g., Is a portable chest x-ray a better choice than the risk of transport? Can the test be postponed? Should the physician accompany the patient?).

An unstable patient should not be transported by a porter alone!

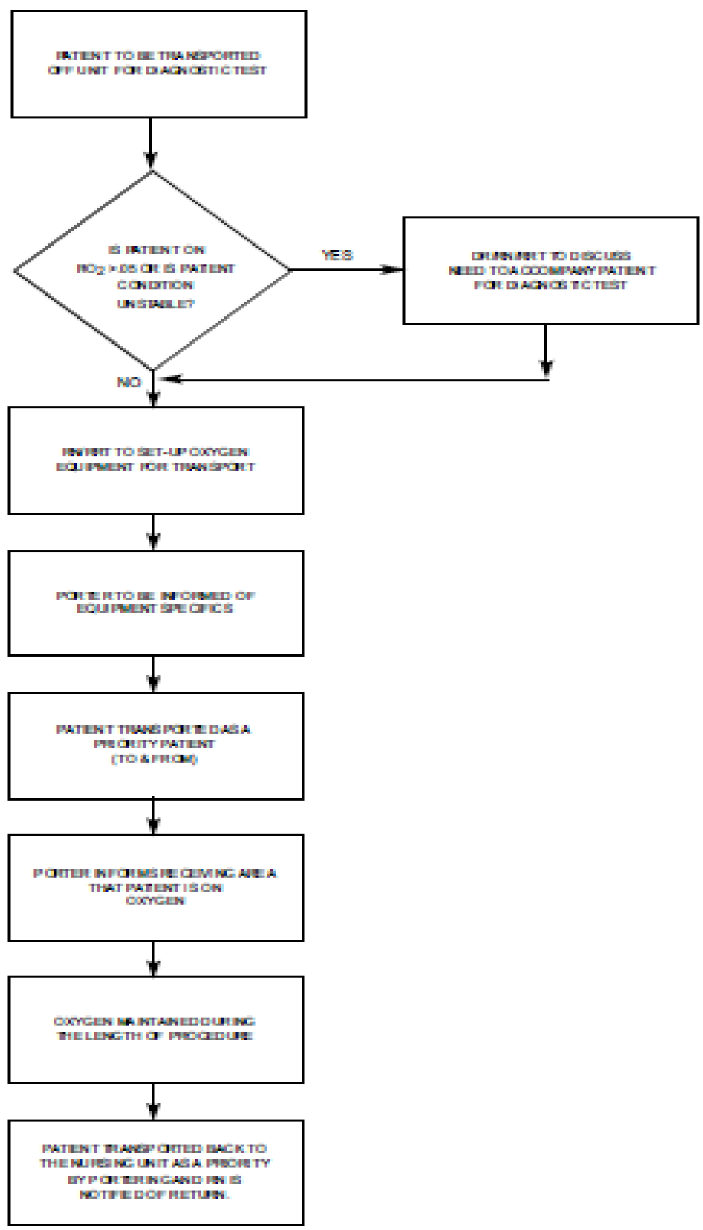
- Prepare portable oxygen.
- Ensure **uninterrupted** therapy during transport.
- Notify dispatch and indicate patient is on oxygen – identify whether Stretcher or wheelchair is required. Patient will be given priority status for transport.
- Notify receiving area prior to transport if oxygen is > 50%.

- Notify RRT prior to transport if patient is receiving > 50%.
- Inform porter of the oxygen concentration /flow rate and check tank volume prior to transport off of the unit. **Do not allow patient to leave with less than 500 psi oxygen supply in the tank… more than 500 psi is necessary!**
- Upon return to the unit, reconnect patient to bedside oxygen system and perform a patient assessment.

WHAT SHOULD I KNOW ABOUT PAEDIATRIC TRANSPORTS?

- All infants must be accompanied by a nurse.
- All paediatric patients receiving **> 35%** oxygen therapy must be accompanied by a nurse.
- Any paediatric patient who is unable to understand the importance/unable to comply with oxygen therapy must be accompanied by a nurse (or a parent if child is stable).
- Accompaniment for all other children is the same as for adult patients (note all children on **> 35% must be accompanied**). Collaboration by the team regarding accompaniment should occur for any unstable child, or where the nurse has identified areas for concern.
- Child Life visits:
  - The nurse will accompany all patients receiving oxygen therapy when being transported to Child Life.
  - The nurse will transfer the oxygen set-up to a wall outlet and ensure that the equipment is working correctly.
  - The nurse will communicate the oxygen therapy requirements to the Child Life Specialist and review the set-up, prior to returning to the nursing unit.
  - If the Child Life Specialist has any concern regarding the oxygen therapy, an RRT should be paged STAT.
  - The nurse will return at completion of the Child Life therapy and accompany the child back to the nursing unit.

GUIDELINES FOR TRANSPORT



WHAT IS THE RESPONSIBILITY OF THE PHYSICIAN RELATED TO THE PROTOCOL?

The physician will:

- Collaborate/communicate with other members of the health care team to deliver goal oriented therapy.
- Identify patients with potential for CO_2 retention and communicate caution to members of the team.
- Order oxygen therapy based on the goal oriented criteria outlined in the flow chart for either acute /chronic /or surgical patients.
- Document rationale if oxygen therapy orders fall outside the criteria indicated in the flow chart.
- Demonstrate knowledge of Oximetry /Oxygen Titration Protocol.
- Reassess oxygen therapy orders following any change in therapy and at appropriate intervals related to patient condition.
- Document assessment findings.

WHAT IS THE RESPONSIBILITY OF THE NURSE RELATED TO THE PROTOCOL?

The nurse will:

- Ensure that there is a physician's order for oxygen therapy and the titration of oxygen therapy.
- Assess oxygen therapy once per shift and prn.
- Collaborate/communicate with other members of the health team to deliver goal oriented therapy.
- Ensure **uninterrupted** oxygen therapy. This includes during transport for tests, ambulation, or periods sitting up in chair.
- Initiate all oxygen orders promptly as per oximetry /oxygen titration protocol as ordered by the physician.
- Notify RRT to assess patient upon initiation of protocol (paediatric patients or adults requiring > 50% oxygen).
- Continue titration protocol based on pulse oximetry to room air trials or home oxygen setting and discontinue oxygen when appropriate.
- Demonstrate competent use of oxygen therapy equipment.
- Document assessment and relevant clinical findings as per documentation protocol.

WHAT IS THE RESPONSIBILITY OF THE RESPIRATORY THERAPIST RELATED TO THE PROTOCOL?

The respiratory therapist will:

- Collaborate /communicate with other members of the health care team to deliver goal oriented therapy.
- Respond immediately to STAT calls or requests for oxygen > 50%, or for calls from diagnostic / treatment areas.
- Perform assessment for all paediatric patients with initiation of oxygen therapy as close to time of admission as possible. Following initial assessment and intervention for acute/non-stable patients continue to follow as per RT protocols. Communicate with the RN the level of care provided for acute patients (e.g., assess /titrate oxygen Q4H).
- Communicate with the RN when a patient is no longer considered “acute” for oxygen therapy and further weaning can be assumed by the RN.
- Ensure appropriate equipment is available to provide **uninterrupted** oxygen therapy.
- Respond to request for humidity consultation when contacted.
- Initiate Oximetry /Oxygen Titration Protocol upon a physician’s order.
- Document assessment findings on the appropriate record.

WHAT IS THE RESPONSIBILITY OF THE PORTER RELATED TO THE PROTOCOL?

The porter will:

- Utilize wheelchairs or stretchers designated as oxygen carriers for transporting patients on oxygen, and treat patients on oxygen as priority calls.
- Ensure uninterrupted therapy throughout transport by reporting and seeking assistance in the event of a tubing disconnection or equipment malfunction.
- Receive information from the nurse regarding the patient's oxygen therapy equipment.
- Inform receiving area that patient has arrived and is on oxygen therapy.
- Recognize low level of oxygen supply in portable tank and proper equipment set up.
- Contact the closest patient care area for assistance if any problems with equipment or patient develop.
- Check level of oxygen in the tank prior to transport. Ensure at least 500 psi on the content gauge.

WHAT IS THE RESPONSIBILITY OF THE DIAGNOSTIC / TREATMENT AREA RELATED TO THE PROTOCOL?

While patients are in the diagnostic/treatment area the team in that specific area is responsible to ensure uninterrupted therapy.

The Diagnostic / Treatment area will:

- Collaborate /communicate with other members of the health care team to deliver goal oriented therapy.
- Ensure uninterrupted therapy upon arrival to unit, while waiting in holding area, throughout the procedure and up to discharge from the area.
- Transfer patient to wall outlet while in the diagnostic / treatment area if available; transfer patient back to portable oxygen for return to floor.
- Contact respiratory therapy STAT for any problems with the equipment or patient's oxygen status.
- Identify the patient to portering services as "on oxygen" to receive priority status for transport.
- Check tank for oxygen level prior to transport.

HOW DO I COMPLETE THIS PROGRAM?

- You have now completed the didactic portion of the oxygen therapy program.
- Test your understanding of the new protocols by doing the Self-Assessment Questions in Part II (the Self-Assessment Module or workbook).
- Once you feel comfortable with the new protocol, complete the post-test and evaluation form attached to the back of the Self-Assessment Package and forward it to your Coordinator.
- Check with your Coordinator for hands-on equipment in-services being offered at your hospital.
- If you need clarification regarding any aspect of this package please contact your unit Clinical Educator/resource nurse or respiratory therapist.

Congratulations ... you are now finished this program!

Thank you for your support as we strive to improve the quality of care delivered to patients.

REFERENCES

1. Petty Thomas L, O'Dononue Walter J. Jr, Further Recommendations for Prescribing, Reimbursement, Technology Development, and Research in Long-Term Oxygen Therapy. Summary of the Fourth Oxygen Consensus Conference, Washington, D.C., October 1993.
2. American Review of Respiratory Disease, Volume 101, 1970, Oxygen Therapy in Cardiopulmonary Disease.
3. Craig Douglas B., Postoperative Recovery of Pulmonary Function, Anaesthesia and Analgesia, Volume 60, No 1. January 1981.
4. Respiratory Care, December '91 Volume 36 No 12, AARC Clinical Practice Guideline, Oxygen Therapy in the Acute Care Hospital.
5. Jones JG, Sapsford DJ, Wheatley RG, Postoperative Hypoxaemia: mechanisms and time course, 1990 The Association of Anaesthetists of Gt. Britain and Ireland.
6. Small D, Duha A, Wieskopf B, Dajczman E, Laporta D, Kreisman H, Wolkove N, Frank H. Uses and Misuses of Oxygen in Hospitalized Patients, The American Journal of Medicine, June 1992.
7. National Conference on Oxygen Therapy (Fulmer, Snider), August 1984, Scientific Basis of Oxygen Therapy.
8. Jeffrey AA, Ray S, Douglas NJ, Accuracy of Inpatient Oxygen Administration, Thorax 1989;44:1036-1037.
9. Brown Lauren Hinson, Pulmonary Oxygen Toxicity. Focus on Critical Care, Volume 17 Number 1:68-75, February 1990.
10. Tinits Peter, Oxygen Therapy and Oxygen Toxicity. Annals of Emergency Medicine, 12:321-328, May 1983.
11. Albin RJ, Criner GJ, Thomas S, Abou-Jaoude S, Pattern of Non-ICU Inpatient Supplemental Oxygen Utilization in a University Hospital. Non-ICU Inpatient Supplement Oxygen Utilization (Albin et al).
12. Brougher et al: Effectiveness of Medical Necessity Guidelines in Reducing Cost of Oxygen Therapy.
13. Annual Meeting of the American Association of Respiratory Therapy, November 1985.
14. Scarborough Centenary Health Centre, Scarborough, Ontario. Oxygen Titration Protocols.
15. St. Joseph's Health Science Centre, London, Ontario. Oxygen Titration Protocols.
16. Kacmarek RM, Stoller, JK, Heuer, AJ.. Egan's Fundamentals of Respiratory Care, 11th Edition 2016, Elsevier Mosby, St. Louis, Missouri. St. Louis Missouri.
17. Cairo, JM. Mosby's Respiratory Care Equipment, 9th Edition 2014, Elsevier Mosby, St. Louis, Missouri.
18. Malley, WJ, Clinical Blood Gases: Assessment and Intervention, 2nd Edition, 2005, Elsevier Saunders. St. Louis, Missouri.