AARC Clinical Practice Guideline

Oxygen Therapy in the Home or Alternate Site Health Care Facility —2007 Revision & Update

OT-CC 1.0 PROCEDURE

The procedure addressed is the administration of oxygen therapy in the home or in the extended care facility other than by mechanical ventilator.

OT-CC 2.0 DESCRIPTION/DEFINITION

Oxygen therapy is the administration of oxygen at concentrations greater than that in ambient air (20.9%) with the intent of treating or preventing the symptoms and manifestations of hypoxia.[1] Oxygen is a medical gas and should only be dispensed in accordance with all federal, state, and local laws and regulations.

OT-CC 3.0 SETTING

This Guideline is confined to oxygen administration in the home or alternate site health care facility (ie, skilled nursing facility, extended care facility).

OT-CC 4.0 INDICATIONS

4.1 Long-term oxygen therapy (LTOT) in the home or alternate site health care facility is normally indicated for the treatment of hypoxemia.[2,3] LTOT has been shown to significantly improve survival in hypoxemic patients with chronic obstructive pulmonary disease (COPD).[4,5] LTOT has been shown to reduce hospitalizations and lengths of stay.[6,7]

4.2 Laboratory indications: Documented hypoxemia in adults, children, and infants older than 28 days as evidenced by [1] $P_{aO_2} \leq 55$ mm Hg or $S_{aO_2} \leq 88\%$ in subjects breathing room air or [2] P_{aO_2} of 56-59 mm Hg or S_{aO_2} or $S_{pO_2} \leq 89\%$ in association with specific clinical conditions (eg, cor pulmonale, congestive heart failure, or erythrocythemia with hematocrit > 56).[8,9]

4.3 Some patients may not demonstrate a need for oxygen therapy at rest (normoxic) but will be hypoxemic during ambulation, sleep, or exercise. Oxygen therapy is indicated during these specific activities when the S_{aO_2} is demonstrated to fall to ≤ 88%.[8]

4.4 Oxygen therapy may be prescribed by the attending physician for indications outside of those noted above or in cases were strong evidence may be lacking (eg, cluster headaches) on the order and discretion of the attending physician.

4.5 Patients who are approaching the end of life frequently exhibit dyspnea with or without hypoxemia.[10,11] Dyspnea in the absence of hypoxemia can be treated with techniques and drugs other than oxygen.[12-14] Oxygen may be tried in these patients at 1-3 liters per minute, to obtain subjective relief of dyspnea.[13]

4.6 All oxygen must be prescribed and dispensed in accordance with federal, state, and local laws and regulations.

OT-CC 5.0 CONTRAINDICATIONS

No absolute contraindications to oxygen therapy exist when indications are present.

OT-CC 6.0 PRECAUTIONS AND/OR POSSIBLE COMPLICATIONS

6.1 There is a potential in some spontaneously breathing hypoxemic patients with hypercapnia and chronic obstructive pulmonary disease that oxygen administration may lead to an increase in P_{aCO_2}.[15-17]

6.2 Undesirable results or events may result from noncompliance with physicians' orders or inadequate instruction in home oxygen therapy.

6.3 Complications may result from use of nasal cannulae[18] or transtracheal catheters.[19]

6.4 Fire hazard is increased in the presence of increased oxygen concentrations.

6.5 Bacterial contamination associated with certain nebulizers and humidification systems is a possible hazard.[20]

6.6 Possible physical hazards can be posed by unsecured cylinders, ungrounded equipment, or

mishandling of liquid oxygen. Power or equipment malfunction and/or failure can lead to an interruption in oxygen supply.

OT-CC 7.0 LIMITATIONS OF PROCEDURE

Oxygen therapy has only limited benefit for the treatment of hypoxia due to anemia and benefit may be limited when circulatory disturbances are present. Oxygen therapy should not be used in lieu of but in addition to mechanical ventilation when ventilatory support is indicated.[21]

OT-CC 8.0 ASSESSMENT OF NEED

8.1 Initial assessment: Need is determined by measurement of inadequate blood oxygen tensions and/or saturations by invasive or noninvasive methods, and/or the presence of clinical indicators as previously described.

8.2 Ongoing evaluation or reassessment: Additional measurements of arterial blood gas tensions and/or saturations by invasive or noninvasive methods may be indicated whenever there is a change in clinical status that may be cardiopulmonary related. Once the need for LTOT has been documented, repeat arterial blood gases or oxygen saturation measurements are unnecessary other than to follow the course of the disease, to assess changes in clinical status, or to facilitate changes in the oxygen prescription.[22,23]

OT-CC 9.0 ASSESSMENT OF OUTCOME

Outcome is determined by clinical and physiologic assessment to establish adequacy of patient response to therapy.

OT-CC 10.0 RESOURCES

10.1 Equipment

10.1.1 Low-flow oxygen systems: Such devices supply oxygen at flows that are less than the patient's total inspiratory demand (ie, the delivered oxygen is diluted with room air). These devices may supply either a low or high F_{IO_2} depending upon the specific design. Reservoir masks or other oxygen devices designed to provide for a high F_{IO_2} are usually not appropriate for prolonged LTOT outside of the hospital.

10.1.2 Nasal cannulae provide approximately 24-40% oxygen with flowrates up to 6 L/min in adults, although the patient's respiratory patterns can influence the actual, delivered F_{IO_2};[24-26] infant flows should be limited to a maximum of 2 L/min.[27,28] Oxygen supplied to adults by nasal cannulae at flows ≤ to 4 L/min need not be humidified.[25,26]

10.1.3 Transtracheal oxygen catheters can provide continuous oxygen therapy. Transtracheal catheters may require greater patient supervision and have an increased risk for complication.[19]

10.1.4 Pulse-dose oxygen delivery devices (PDOD), demand oxygen delivery systems (DODS) and other types of oxygen-conserving devices.

10.1.4.1 PDOD/DODS devices are normally either electronic or mechanical (pneumatic) and may be time-cycled and/or operate on demand, responding to a pressure drop triggered by the user's inspiratory effort and then delivering a predetermined bolus of oxygen. Some PDOD/DODS devices may deliver a bolus only, while other devices deliver a bolus followed by a set flow of gas until the demand valve closes. PDOD/DODS may be used with compressed cylinders, liquid vessels, and oxygen concentrators and are normally incorporated to extend the functional time or duration of use of the oxygen system. PDOD/DODS devices cannot be used with bubble humidifiers. PDOD/DODS have varying performance characteristics, which include bolus volume, trigger sensitivity and trigger response time. These differences may be relevant and therefore clinicians should be familiar with the device specifications.[29] PDOD/DODS systems have been shown to be clinically effective in resting, exercising and sleeping patients.[30-38] The current published literature and expert consensus statements recommend that patients be prescribed and evaluated for use of a specific PDOD/DODS or oxygen conserving device.[39]

10.1.4.2 Oxygen reservoir cannulae (nasal or pendant) and transtracheal catheters are some other examples of devices being utilized for oxygen conservation.

10.1.5 High-flow oxygen delivery systems: Such devices can provide a prescribed gas mixture of high or low oxygen concentration at flows that exceed patient demand. Tracheostomy collars and T-tube adapters may be used with high-flow supplemental oxygen systems. The gas should be humidified by a continuous aerosol generator or a heated humidifier.[40,41] The humidifier is preferable because of the greater likelihood for the transmission of contagion via nebulizer.[42]

10.2 Oxygen supply systems

10.2.1 Oxygen concentrators: Concentrators efficiently and effectively concentrate oxygen derived from ambient air by filtering the gas using a chemical sieve material (commonly ceramic zeolite) and a gas separation method known as pressure-swing-adsorption (PSA). Oxygen concentrators should deliver oxygen at concentrations of 85% or greater at the prescribed liter flow or setting. For the purposes of low flow oxygen applications, concentrations of 85% or greater are considered therapeutically equivalent to 100%.[43,44] Modern oxygen concentrators include stationary devices, portable devices, and systems that can transfill oxygen cylinders. Oxygen concentrators typically provide oxygen flows of 1 to 5 L/min with specific makes and models capable of flows up to 10 L/min.[45]

10.2.2 Liquid oxygen systems: Liquid oxygen reservoirs are insulated containers designed to prevent heat transfer and maintain an oxygen temperature of approximately -297°F. Liquid oxygen is provided in large reservoir canisters with smaller portable units that can be transfilled by the patient. There is evaporation loss from the canisters when they are not in use. Gas formed by the evaporation is normally released into the atmosphere via a pressure relief valve. The evaporation rates vary by make and model of reservoir. Modern portable liquid oxygen units incorporate PDOD/DODS oxygen conserving technology.[45,46]

10.2.3 Compressed gas cylinders: Although less practical for flows > 1 L/Min, compressed oxygen may be supplied in large cylinders (eg, H cylinders) to serve as stationary units for home oxygen therapy. Smaller, lightweight cylinders are available in a variety of size/weight configurations (eg, M-6, M-9, D)and may be used for portability, ambulation, and as backup to a stationary oxygen system in the event of power failure or equipment malfunction. Small cylinders may be used in conjunction with oxygen conserving devices and carrying bags and/or wheel carts.

10.2.4 Delivery/setup of oxygen equipment: The delivery, setup, and basic instruction on the use and maintenance of home oxygen equipment shall be performed in accordance with applicable federal, state, and local laws. Patients and/or their caregivers may operate and maintain oxygen delivery devices after they have been instructed and have demonstrated the appropriate level of skill.

10.3 Personnel:

10.3.1 Clinical/professional personnel: Licensed and/or credentialed respiratory therapists (RRT or CRT) or other licensed health care professionals functioning within the scope of practice as required by the state standards under which the professional is licensed may assess patients, initiate and monitor oxygen delivery systems, recommend changes in therapy, and instruct patient and caregivers. All clinical services relating to the provision of home oxygen therapy should be performed in accordance with applicable federal, state, and local law, specifically the respiratory therapy practice act in that state.

OT-CC 11.0 MONITORING

11.1 Patient

11.1.1 Initial and ongoing patient clinical assessment of oxygen patients should be

performed by licensed and/or credentialed respiratory therapists (RRT or CRT) or other professional persons as defined in 10.3 with equivalent training and documented ability to perform the tasks as part of a patient specific plan of care/plan of service. Care plans should be developed at the initiation of oxygen therapy based on the needs of the individual patient and updated as necessary.

11.1.2 Measurement of baseline oxygen tension and/or saturation is essential before oxygen therapy is begun.[8] These measurements should be repeated when clinically indicated or to follow the course of the disease, as determined by the attending physician. Measurements of oxygen saturation also should be made to determine appropriate oxygen flow or PDOD/DODS setting for ambulation, exercise, or sleep.[39]

11.2 Equipment maintenance and supervision: All oxygen delivery equipment should be checked at least once daily by the patient or caregiver. Facets to be assessed include proper function of the equipment, prescribed flowrates, remaining liquid or compressed gas content, and backup supply. Oxygen equipment (concentrators, liquid systems, and cylinders) should be serviced and maintained in accordance with the manufacturer specifications and consistent with all federal, state, and local laws and regulations. In the event there are no manufacturer specifications or guidance, oxygen equipment should be checked for proper function and performance by an appropriately trained and/or credentialed person no less than once per year.

OT-CC 12.0 FREQUENCY

Oxygen therapy should be administered in accordance with the physician prescription. Oxygen therapy use in chronic obstructive pulmonary disease for the treatment of chronic hypoxemia should be administered continuously (ie, 24 hours per day) unless the need has been shown to be associated only with specific situations (eg, exercise and sleep).

OT-CC 13.0 INFECTION CONTROL

Under normal circumstances low-flow oxygen systems without humidifiers do not present a clinically important risk of infection and need not be routinely replaced. High-flow systems that employ heated humidifiers or aerosol generators, particularly when applied to patients with artificial airways, can be important sources of infection and should be cleaned and disinfected on a regular basis, although there are no definitive studies regarding the frequency of tube changes at home or in long-term care facilities.[47]

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