

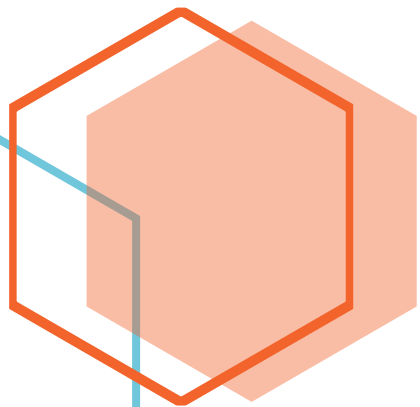


Oxygen Therapy in COVID-19 Patients

A quick reference guide

Indian Association of Respiratory Care

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Oxygen Therapy in COVID-19 Patients

A quick reference guide

COVID-19 patients might develop hypoxic respiratory failure. Early recognition and referral of patients with worsening respiratory function while on room air important to ensure timely and safe escalation of respiratory support. A patient may need oxygen to keep the workload of the heart and lungs at a normal level.

Health Care Providers (HCPs) should be strict in following the recommended PPE recommendations.

Aim

The aim of this guideline is to standardize and optimize the usage of oxygen therapy among health care workers.

Targeted Population

All adult COVID 19 patients who are requiring oxygen therapy in the ED, hospital wards, and Intensive Care Units.

Targeted End User

Physicians

Respiratory Therapists

Nurses

All qualified health care providers who treat the COVID 19 patients.



Signs for need of oxygen therapy

Tachypnea, dyspnea, cyanosis.
Palpitations, Weakness, tremors,
incoordination.
Increased CO, tachycardia, arrhythmias.
Hypotension, angina, diaphoresis, shock.
Headache, confusion, euphoria.
Delirium, papilledema, seizures.
Obtundation and coma.
Lactic acidosis, sodium and water retention.



Oxygen Delivery Systems

Home oxygen concentrator



- Oxygen concentrator physically separates oxygen present in room air from nitrogen, carbon dioxide and water.
- At flows of 1-2L/m the concentrator delivers 92%-95% oxygen
- At flows of 3-5L/m the oxygen percent falls to 85%-93%
- Preferred when continuous use is required.

Caution

- Requires electricity at all times
- In case of power loss, backup oxygen supply like the cylinder is required
- Oxygen concentration reduces with increasing flows.

Portable oxygen concentrator

- A portable oxygen concentrator is similar to home oxygen concentrators, but they're smaller and easy to carry.
- At flows of 1-2L/m the concentrator delivers 92%-95% oxygen.
- At flows of 3-5L/m the oxygen percent falls to 85%-93%.
- Can be operated on electricity as well as battery, and even plugged into a car lighter electrical outlet ad use.





Liquid Oxygen



Liquid Oxygen

- 1 L liquid oxygen provides 860 L of gaseous oxygen.
- For a set flow of 2L/min, 1L liquid O₂ will last for 8-10 hrs.
- Lightweight, portable and can deliver oxygen at all flow rates (1-15 L/min).
- Does not require electricity, relatively silent.

Caution

- Contents of reservoir and cylinder evaporates.
- Cannot be used along with mechanical ventilators.
- Extreme precautions during refilling.

Compressed Oxygen Cylinder



Compressed Oxygen Cylinder

- Compressed cylinder contains oxygen in gaseous form
- It requires a pressure-reducing valve and a flow meter to deliver the desired flow of oxygen.
- Small cylinders are portable, available easily
- It can deliver wide range of flows (1–15 L/min)

Caution

- Large cylinders are heavy, bulky and not portable.
- High-pressure safety hazard (approx. pressure of 2200psi).



Calculating the cylinder duration

$$\left(\text{Cylinder Duration in Minutes} = \frac{\text{Cylinder Pressure (psig)} \times \text{Cylinder Factor}}{\text{Flow (L/min)}} \right)$$

Note:

- *Cylinder Pressure: Read the pressure on the pressure gauge on the cylinder.*
- *Cylinder Factor: Constant for specific cylinders.*

Cylinder Factor for Commonly used cylinder			
D/M-15	E/M-24	G/M/MM/M122	H and K/M250
0.16	0.28	2.41	3.14

- *Flow of Oxygen as prescribed.*

For example: How long will H/M250 cylinder with 2000psi on flow of 2 L/min last?

$$\begin{aligned} \text{Cylinder Duration in Minutes} &= \text{Cylinder Pressure (psig)} \times \text{Cylinder Factor} / \text{Flow (L/min)} \\ &= (2000 \times 3.14) / 2 \\ &= 3140 \text{ minutes (3140/60=52 hours)} \end{aligned}$$

This cylinder will last for approximately 52 hours at a flow rate of 2 L/Min

Caring the for the oxygen delivery device

1. Oxygen concentrators must be used according to the manufacturer’s specifications
2. Cylinders shall be stored in a cool, dry, well-ventilated place under cover, away from boilers, open flames, steam pipes or any potential sources of heat and such place of storage shall be easily accessible.
3. Cylinders must always be placed in a trolley or safely secured while using.

Caution

Ensure that a replacement cylinder is available when the volume indicator gauge shows only one quarter full.



Flow meters & Regulators



Flow Meters

- Flowmeters are devices that help deliver a fixed flow of oxygen to the patient. Flowmeters allow rate of gas flow to patient to be set & controlled.
- It can deliver oxygen between range of 1L/min to 15 L/min in adult versions.



Regulators

The oxygen on the cylinders is filled with a high pressure on 2000-2200 psi. In order to deliver appropriate amount of oxygen, the pressure of the gas needs to be reduced so that it can be safely given to the patient. Thus, a pressure regulator is used which reduces the

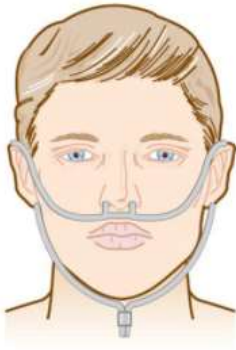




Delivery devices / Interfaces

Nasal Cannula

Disposable plastic tube with two prongs that delivers oxygen through the nares



Over-the-ear style nasal cannula

- Use only in mild hypoxemia.
i.e. Saturation (SpO_2) 90%-95%.
- Maintain Oxygen flow rates of 1 to 6 L/min.
- Add humidification for flows over 4L.

Caution

- Do not use for mouth breathers.
- Check for kinking of the tube.
- Do not use in patients with low inspiratory flow and very slow or very high respiratory rate.
- Check for dislodgement, Higher flows are uncomfortable



Quick estimated FIO₂

Oxygen Flow	FiO ₂
1 L/Min	24%
2 L/Min	28%
3 L/Min	32%
4 L/Min	36%
5 L/Min	40%
6 L/Min	44%

Attention!!

Observe the patient's nose and ears to ensure there is no redness or pressure ulcers developing.



Simple Face Mask

The simple facemask (SFM) is a basic disposable mask, made of clear plastic, to provide oxygen therapy. It is shaped to fit over the mouth and nose with a port at the bottom for the connection of oxygen tubing.



Simple Face Mask

- Use in patients with mild to moderate hypoxemia. i.e. 89%-85% of SpO₂.
- Maintain Oxygen flow rates of 5 to 8 L/min.
- It delivers oxygen concentrations from 40% to 60% at flow rates of 5 to 8 L/min.
- Minimum flow rate is 5 L/min to ensure flushing of CO₂ from the mask.

Caution

- *Vomitus may aspirate if go unnoticed.*
- *Avoid excessive pressure on straps.*
- *Re-assure the mask as fixed properly after removing it for eat, drink or speak.*
- *Not recommended for mild COPD.*
- *Attach humidifier is used more than 12h continuous.*



Quick estimated FIO₂

Oxygen Flow	FiO ₂
5 L/Min	40%
6-7 L/Min	50%
8 L/Min	60%



Non-rebreathing Mask

A non-rebreather mask is a medical device that helps deliver high concentration oxygen; it has a facemask connected to a reservoir bag and a plastic tube to connect to the oxygen source.

- Use only in patients severe hypoxemia. i.e. Less than 85% of SpO₂.
- It has three one-way valves that prevents the patient from exhaling CO₂ into the reservoir bag.
- Maintain minimum 10L/min Oxygen flow rates to prevent the reservoir bag from collapse on inspiration.
- It delivers oxygen concentrations from 55% to 95% at flow rates of 10 to 15 L/min.
- Sufficient flow rates must be maintained; evidenced by reservoir bag always being at least 1/3 inflated.



Caution

- Suffocation hazard- Malfunction can cause CO₂ buildup, suffocation.
- Not suitable for long term use

Non-rebreathing Mask

Quick estimated FIO₂

Oxygen Flow	FiO ₂
10 L/Min	80-90 %
12 L/Min	90%
15 L/Min	90-100%



Attention!!

Check the bag and valve before use.

Procedure: After setting the flow rate of oxygen, occlude the valve between mask and reservoir bag to make the reservoir bag fill with oxygen. Then squeeze the reservoir bag; if it empties, the valve is working correctly. Then reinflate the reservoir bag before fitting the mask onto the patient to ensure that the appropriate concentration of oxygen will be delivered to the patient.

Oxygen Therapy in COVID-19 Patients



Monitoring during Oxygen Therapy

Monitor the signs of failure of conventional Oxygen Therapy

Vital sign assessments

Pulse Oximetry, Arterial Blood Gases

Work of Breathing

Tidal Volume and Respiratory Rate

Pulse and Blood Pressure

Maintain par levels of supplies

Readjust interface routinely to avoid pressure sores.

Need for ongoing care

Observe the patient's color and perfusion, oxygen saturations and respiratory pattern.

Offer drinks or mouth washes, to avoid mouth & mucous dryness

Additional Note on Hazards

Too much oxygen for a known COPD patient can cause a depression in ventilation by "knocking out" their hypoxic drive.

FiO₂s greater than 50% can lead to Nitrogen wash out resulting in Absorption atelectasis.

Contraindications

There are no specific contraindications to oxygen therapy when indications are judged to be present

Potential threats of Hyperoxia and oxygen therapy

1. Worsened V/Q mismatch
2. Depression of ventilation
3. Absorption atelectasis
4. Reduced cardiac output
5. Damage from oxygen free radicals
6. Increased systemic vascular resistance
7. Delay in recognition of clinical deterioration

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References

1. GSR. 1081(E).— the Gas Cylinder Rules, 2015. published as required by Section 18 of the Explosives Act, 1884 (4 of 1884) in the Gazette of India, Extraordinary, Part II, Section 3, Sub-Section (i) dated the 13th October, 2015
2. Kacmarek, R. and Egan, D., n.d. Egan's Fundamentals of respiratory care.
3. WHO-Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected Interim guidance (v.1.2); published- 13 March 2020 ; WHO/2019-nCoV/clinical/2020.4
4. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z et al; Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China-a retrospective cohort study, *Lancet*. 2020 ; 395(10229):1054-1062
5. WHO -Oxygen sources and distribution for COVID-19 treatment centres: interim guidance; published 4 April 2020; <https://apps.who.int/iris/bitstream/handle/10665/331746>
6. Drafting and reviewing acknowledgement: Indian Academy of Respiratory Care, the academic wing of Indian Association of Respiratory Care (www.iarc.in)

