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Opinion

Ready Reckoner on Oxygen Therapy in COVID-19 Patients for Use of Medical Practitioners

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Introduction

The COVID-19 pandemic uncovered several weaknesses of the health system of both developed as well as developing countries. Several studies have reported inappropriate oxygen prescribing practices and a huge gap in the knowledge of health-care providers on various aspects of oxygen therapy [1-2]. This may be attributed to the fact that the oxygen therapy as subject is taught in the medical curriculum of mainly post-graduation in anaesthesiology/critical care and pulmonary medicine.

Review of literature revealed that the first formal guideline on oxygen therapy in adults in health care and emergency setting was released by British Thoracic Society in 2008 updated in 2017 [3]. In 2015, Thoracic Society of Australia and New Zealand [4] also issued oxygen therapy guidelines for acute oxygen use in adults. However, despite being available a lot need to be done to ensure their dissemination for optimum use of oxygen, especially at the time of COVID-19 crisis considering acute shortage of oxygen encountered in India during the 2nd wave of COVID-19 in April 2021.

The aim of this communication is to prepare a 'Ready Reckoner on Oxygen Therapy' for use of Medical Practitioners for optimum management of hypoxic patients, prevent toxicity of oxygen and reduce wastage of the lifesaving scarce resource.

Oxygen therapy in COVID-19 patients

Standard oxygen therapy [3,4]

When to give oxygen and when not to give

Oxygen therapy is indicated when peripheral oxygen saturation (SpO2) < 92% [Note: In patients suffering from Chronic obstructive pulmonary disease, oxygen therapy is indicated when SpO2 < 88%]

Do not start Oxygen if SpO2 ≥ 92%.

[Note: In patients suffering from COPD do not start Oxygen if SpO2 ≥ 88%]

2. Awake Proning Position for 12 - 16 hours per day is recommended.

3. Hypoxia (SpO2 < 90) is a medical emergency and oxygen administration should be started even without any written order. This should be followed by written order by doctor.

Oxygen is a drug and should be prescribed on case record of the patient by

recording following details

- Initial SpO2 in room air
- Desired SpO2 Target: Adults (Target: 92% - 96%), COPD patients (Target: 88% - 92%) and Pregnant women and children (Target: 94% - 96%)
- Oxygen administration device to be used- nasal-prongs, or simple oxygen face mask, or Non-Rebreathing Mask [NRBM}, or Venturi mask, or High Flow Nasal Cannula [HFNC] etc.
- Initial Oxygen Flow to be as per patient's SpO2.

If SpO2 < 85%

10-15 L/min (NRBM) for short duration as emergency rescue therapy for severe hypoxia. When minimum target SpO2 of 92% is achieved, the oxygen delivery may be done by using simple oxygen face mask.

If SpO2 > 85%- < 90%:

2 - 4 L/min (Nasal prongs, can go up-to flow of 6L/min if target not achieved) or (face mask 5 L/min, can go up-to flow of 10 L/min to achieve minimum desired SpO2 target).

In COPD patients start low flow oxygen by nasal prongs @ 1-2 L/min to prevent danger of hypoventilation.

Which oxygen delivery device to be used

- Nasal Prongs (Flow 0.5 - 6 L/min; FiO2: 0.23 to 0.4)
- Simple Oxygen Face Mask (Flow 5 - 10 L/min; FiO2: 0.4 to 0.6)
- Venturi Mask (Flow 2 - 15 L/min; FiO2: 0.24 to 0.6)
- NRBM Mask (Flow 10 - 15 L/min; FiO2: 0.80 to 0.95)
- High Flow Nasal Cannula (HFNC) or continuous Positive Airway Pressure (CPAP) - If intractable Hypoxia not responding, use HFNC or intermittent CPAP (if HFNC not available).

Stepping up Oxygen Flow and FiO2 based on oxygen requirement of the patient using SpO2 measurement initially every 5 minutes

- Stepping up @ 1 L/min oxygen flow every 5-minute, checking SpO2 every 5 minutes till minimum desired SpO2 is achieved (SpO2 92% minimum, COPD patient SpO2 88% minimum)
- Nasal cannula- maximum 6 L/min flow and FiO2 -0.4
- Face mask- maximum 10 L/min flow and FiO2 -0.6

- NRBM- maximum 15 L/min flow and FiO2 -0.95
- Venturi Mask- maximum 15 L/min flow and FiO2- 0.6
- HFNO – maximum up to 60L /min flow and FiO2 1.00

maximum up to 25L /min flow in children.

Maintaining minimum desired SpO2 (≈92%) by administering Oxygen at minimum FiO2 (fraction of inspired oxygen) as Oxygen is toxic as well.

- If FiO2 of near 0.95 - 1.00 is used for long time, there may be risk of absorption atelectasis and gas exchange will decrease in lungs despite oxygen therapy
- If FiO2 > 0.6 is given for ≥ 24 hours, lung can suffer from ARDS, what harm virus had to do the oxygen may do.
- If SpO2 crosses 96%, decrease Oxygen flow by 1 Litre/min and check SpO2 after 5 minutes with aim to keep SpO2 maximum up-to 96%.

Stepping down oxygen flow and FiO2

- Once patient is stable on a particular Oxygen Flow and FiO2 for 24 hours, stepping down Oxygen flow is most important to prevent Oxygen Wastage and Oxygen Toxicity
- Stepping down to be gradual and Oxygen should not be discontinued suddenly as then severe 'Rebound Hypoxia' can ensue.
- Step down @ 1 L/min oxygen flow every 4 - 8 hours till patient is stable (normal desired SpO2 92% - 96%) on 2 L/min (FiO2 < 0.4) before discontinuation of Oxygen Therapy.

Continue monitoring SpO2 after discontinuing Oxygen for at least 24 hours (two-consecutive SpO2 readings to be taken and reported normal)

Recognize severe hypoxemic respiratory failure when patient is failing to respond to standard oxygen therapy [5]

For patients who continue to deteriorate despite using NRBM mask (flow rates of 10–15 L/min FiO2 0.95) and develop Hypoxic Respiratory failure then:

Start High Flow Nasal Oxygen (HFNO) to reduce the need for mechanical ventilation by intubation. Adult HFNO systems (max flow up to 60 L/min of gas flow and FiO2 up to 1.0) and Paediatric circuits max flow up to 25 L/min.

Patients with hypercapnia (exacerbation of obstructive lung disease, cardiogenic pulmonary oedema), hemodynamic instability, multiorgan failure, abnormal mental status should generally not receive HFNO, although emerging data suggest that HFNO may be safe in patients with mild-moderate and non-worsening hypercapnia.

Patients receiving HFNO should be given 1 hour trial and in case the patient acutely deteriorates or does not improve after a short trial should be put on mechanical intubation.

Episodic high continuous positive airway pressure (CPAP) at 30–40 cm of H2O may be tried in Acute Hypoxemic Respiratory failure if HFNO fails or unavailable.

Non-invasive ventilation (NIV)/ Bi-level positive airway pressure (BiPAP)

The current guidelines do not recommend using BiPAP in hypoxemic respiratory failure with normal paCO2 (apart from cardiogenic pulmonary oedema and postoperative respiratory failure) or pandemic viral illness (studies of SARS and pandemic influenza). There is risk of delayed intubation, large tidal volumes, and pulmonary barotrauma and high failure rate in patients with other viral pneumonias who received NIV.

However, a trial of NIV for 1 hour may be given under supervision and in case the patient acutely deteriorates or does not improve after a short trial, should be put on mechanical intubation.

Patients with haemodynamic instability, multiorgan failure, or abnormal mental status should not receive HFNO or NIV and should be put on invasive mechanical ventilation.

Mechanical ventilation

Before intubation pre-oxygenate with 100% FiO2 for 5 minutes, via a face mask with reservoir bag, bag-valve mask, HFNO or NIV. Rapid-sequence intubation is appropriate after an airway assessment that identifies no signs of difficult intubation

Adults

- Tidal volumes (4 - 8 mL/kg predicted body weight) and
- Peak Inspiratory pressure (< 30 cmH2O).
- Permissive hypercapnia is permitted.

Children

- Tidal volumes (3 - 8 mL/kg predicted body weight) and
- Peak Inspiratory pressure (< 28 cmH2O).

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