Letter to Editor

The liberal use of oxygen: Is it justified?

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Sir,

The COVID pandemic has led to a hasty and often unfounded scramble to procure medical oxygen by governments, medical practitioners, and the lay public alike. It is imperative to have a clear understanding of oxygen therapy and the concepts of permissive hypoxemia and hazards associated with hyperoxia.

One of the fields in which liberal oxygen therapy is well-established is in the treatment of acute coronary events under the rationale that it reduces the size of infarcts. Similarly, oxygen is routinely used in the treatment of strokes with the understanding that it prevents further disability by preserving the "penumbra" region. With arterial blood gas analysis becoming a standard of care in most emergency and intensive care settings, many patients with normal oxygen saturation were noted to be actually hypoxemic; hypoxemia being defined as the partial pressure of oxygen (PaO_2) <60 mmHg. This has led to oxygen being liberally used in the emergency setting and was considered safe.

Several landmark trials over the past decade have demonstrated the ill effects of liberal O_2 therapy and ushered in the concept of permissive hypoxemia. A multicenter cohort study done by Kilgannon in 2010 which looked at the clinical outcome in over 6000 patients admitted to intensive care unit (ICU) following resuscitation from cardiac arrest concluded that hyperoxia (PaO_2 > 300 mmHg) was independently associated with increased in-hospital mortality compared with either hypoxia (PaO_2 < 60 mmHg) or normoxia [1]. Two trials in 2015 looked into the role of oxygen in myocardial infarction (MI). The Air Versus Oxygen in Myocardial Infarction trial enrolled patients with ST-elevation myocardial infarction (STEMI) who were normoxic (SpO_2 > 93%) on room air and randomized them into an "Oxygen arm" and a "No oxygen arm." This study concluded that the use of oxygen in normoxic STEMI patients was associated with increased incidences of arrhythmias, recurrent MI, and increased infarct size [2].

The other study, the Supplemental Oxygen in Catheterized Coronary Emergency Reperfusion study randomized 100 normoxic STEMI patients accepted for a primary percutaneous coronary intervention (PCI) to standard oxygen therapy (10 L/min) or no supplemental O_2 to be given until the end of the primary PCI. The study concluded that oxygen may not be beneficial for patients with acute MI and is possibly even harmful [3]. Another study on the role of oxygen in MI was the Determination of the Role of Oxygen in Suspected Acute Myocardial Infarction, a large Swedish multicenter randomized controlled trial (RCT) in 2017, involving 6629 non-hypoxemic patients with suspected MI. Routine use of supplemental oxygen in patients with suspected MI who did not have hypoxemia was not found to reduce 1-year all-cause mortality [4].

The Oxygen-ICU trial, a single-center Italian RCT in 2016 of 434 patients admitted to ICU with an expected stay of 72 h or longer, compared conservative oxygen therapy (aiming for PaO_2 70–100 mmHg or SpO_2 between 94% and 98%) and conventional oxygen therapy (aiming for PaO_2 up to 150 mmHg or SpO_2 between 97% and 100%). The study concluded that conservative oxygen therapy has significantly lower ICU mortality as well as a lower incidence of shock [5]. The Improving Oxygen Therapy in Acute-illness systematic review and meta-analysis published in 2018 concluded that hyperoxia caused by liberal oxygen strategy increases mortality [6].

The ICU-ROX Australian RCT in 2019 randomized 965 intubated and mechanically ventilated patients into conservative oxygen (aiming for SaO_2 just above 90%) and usual oxygen (aiming for any SaO_2 >90%). There was no difference in ventilator-free days or 180-day mortality and cognitive function between the two groups [7]. The recent Handling Oxygenation Targets in the ICU study in 2021 compared oxygen therapy targeting PaO_2 60 mmHg versus PaO_2 90 mmHg, in 2928 ICU patients admitted with hypoxic respiratory failure. This study concludes that there is no harm in aiming for a lower PaO_2 of 60 mmHg [8].

There are several guidelines of the International Thoracic Societies. The British Thoracic Society guidelines in 2017 recommend administering oxygen to achieve a target SpO_2 94–98% for most acutely ill patients or 88–92% in those at risk of hypercapnic respiratory failure. Acute hypoxemia should be managed with oxygen through reservoir mask at 15 L/min only if initial SpO_2 below 85%, otherwise nasal cannula or simple face mask [9]. The Thoracic Society of Australia and New Zealand

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has similar guidelines which recommend oxygen be prescribed in COPD/chronic respiratory failure patients only if SpO_2 <88% and to aim for SpO_2 88–92%. In other acute medical conditions such as cardiorespiratory or metabolic dysfunction, or if oximetry is unreliable, oxygen is prescribed only if SpO_2 is <92% and titrated to a target SpO_2 92–96% [10].

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