

Oxygen Therapy in Acute Care Medicine



Oxygen therapy is a commonly used strategy in modern medicine. In most situations with declining oxygen saturations, clinicians are quick to use this technique. While effective in the setting of hypoxia, there are, however, some circumstances in which excess oxygen is indiscriminately administered for extended periods.

In healthcare, there has been a significant shift from the concept of "more is better" to "less is more." There is also now greater awareness that some therapies may have been inappropriately used over the years. The same focus is now being placed on oxygen therapy, and it is believed that excess oxygen therapy may be harmful to certain patients.

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Oxygen toxicity was first recognised in the 1940s, during an outbreak of retinal hyperplasia in premature infants. Oxygen pneumonitis was first described in the 1970s when autopsies revealed lung injury among patients who were exposed to concentrations of oxygen greater than 0.60 for at least 3 days of mechanical ventilation. Among critical care patients, focus on the harms of hyperoxia increased after recognition of ventilator-associated lung injury.

Hyperoxia leads to excess reactive oxygen species (ROS), which leads to oxidative injury. This, in turn, leads to poor mucociliary clearance, surfactant impairment, airway irritation, and alterations in the microbial flora of the airways.

Recent findings suggest significant harm attributed to hyperoxia and hyperoxaemia across several acute care conditions. In a study with patients who had experienced cardiac arrest and hypoxic-ischaemic encephalopathy, patients with hyperoxaemia had an increased risk of in-hospital mortality compared with patients who had hypoxaemia as well as those who had normal oxygenation.

In another study, the AVOID trial, patients with ST-elevation myocardial infarction were randomly assigned to receive supplemental oxygen or ambient air. Findings showed that patients who received liberal oxygen experienced larger myocardial infarct size and higher frequency of recurrent myocardial infarction.

In 2016, the World Health Organization (WHO) recommended the use of a high fraction of inspired oxygen of 0.80 during general anaesthesia for adults undergoing surgery. But an analysis of 17 clinical trials demonstrated no benefit from a higher vs. lower fraction of inspired oxygen in reducing surgical site infections. Short term exposure to hyperoxia during cardiopulmonary bypass was not found to be associated with adverse neurologic complications. The WHO modified its recommendation in 2018.

The potential risks of hyperoxia in patients with traumatic brain injury or stroke still remain unclear. However, based on the harms of hyperoxaemia observed in other patient populations, there is a possibility that hyperoxaemia may potentiate secondary brain injury. That is why experts caution against the liberal use of oxygen therapy and advise the adoption of conservative oxygen protocols.

The biggest benefit of liberal oxygen therapy is its bactericidal effect, which can be beneficial in the setting of wound infections. In the Hyperoxia and Hypertonic Saline in Patients With Septic Shock (HYPER2S) trial, researchers examined the potential benefits of hyperoxia in patients with sepsis. The trial was stopped early due to the risk of increased mortality in the hyperoxia group. But in another study that evaluated conservative oxygen therapy in patients with sepsis, higher mortality was observed in the conservative oxygen therapy group, again creating confusion as to whether a higher oxygen threshold may have beneficial properties in patients with sepsis.

The Oxygen-ICU trial involving critically ill patients with an anticipated ICU stay of at least 72 hours showed that a conservative oxygen therapy approach resulted in lower mortality compared to a liberal approach. More recently, the ICU-ROX trial has again raised questions about the harms associated with oxygen therapy.

It is important for clinicians to understand that a conservative oxygen therapy approach does not mean permissive hypoxia. While targeted oxygen therapy for wound infections is an appropriate strategy, the indiscriminate use of oxygen resulting in hyperoxia or hyperoxaemia is not necessary and could potentially cause harm in certain acute care conditions.

Source: [JAMA](#)

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