

## Supplemental Oxygen: Use it Conservatively and Judiciously for the Management of Patient

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### Abstract

Oxygen is one of the most extensively used drugs in hospital settings in a wide range of medical specialties for the treatment purpose. Supplemental oxygen as a therapy is recommended for all the patients with acute hypoxemia and for the patients who are at risk of developing hypoxemia. Like any other drug, oxygen has indications, contraindications, dosage, toxic effects, route of administration, methods of delivery etc. Hence, it must be prescribed by medical practitioner and administered and monitored by well-trained healthcare professionals. The results of studies support the conservative use of supplemental oxygen rather than its liberal use. The harmful effects of it depend on underlying conditions, duration, and degree of the hyperoxic exposure. Always consider and use oxygen as a drug and use it conservatively and judiciously for the management of hypoxemic patient.

**Keywords:** Hypoxemia; Hyperoxia; Supplemental Oxygen

### Introduction

Oxygen is a gas. It is a fundamental element for the survival of human beings. It plays a key role in a varied range of biological and physiological processes in the human body [1]. It is most commonly used drug in emergency medicine, intensive care and ward settings. There are misconceptions about its use like it relieves dyspnea, one can give too much oxygen. Also, there are issues such as poor prescribing practices [2]. It is often administered to the patient at care givers discretion [3].

### Objective of the Study

The objective of this mini review is to convey the healthcare givers to prescribe and use oxygen conservatively and judiciously.

### Methodology

The articles were searched surfing the google search engine. The keyword used for search were oxygen therapy; supplemental oxygen; oxygen as a drug; use of oxygen; toxicity of oxygen; oxygen use in emergency; oxygen therapy guidelines; and oxygen use in critical care. The original articles, review articles and guidelines were searched using mentioned key words published in last 10 years. The ten years limitation was based on the objective of the study how use of supplemental oxygen has updated in last decade. All downloaded articles were studied; among them 20 articles (including original, review and guidelines) selected for reference. Later on, three articles selected from references of chosen article, downloaded, studied and included.

### Supplemental Oxygen

The supplemental oxygen is a treatment for hypoxaemia but not of breathlessness [2]. It may not cure the lung diseases but an important remedy that decreases the severity of symptoms and improve organ functions [4]. Oxygen is one of the most widely used drugs in hospital settings in a wide range of medical specialties for the treatment purpose. In certain conditions it is used for long-term [5]. It is amongst the most universally used agents for the treatment of critical illnesses and part of the routine treatment such as in acute shock and emergency medicine [6,7].

### Category of patient requiring supplemental oxygen therapy

Supplemental oxygen as a therapy is recommended for all patients with acute hypoxemia and for the patients who are at risk of developing hypoxemia such as major trauma, shock. The oxygen therapy is recommended for major medical emergencies and critical illnesses such as cardiac arrest or resuscitation, shock, sepsis, major trauma, drowning, anaphylaxis, major pulmonary hemorrhage, status epilepticus, major head injury, carbon Monoxide poisoning. Some serious illnesses require supplemental oxygen if the patient is hypoxemic such as patient with acute hypoxemia cause yet to be determined, acute asthma, acute exacerbation of chronic obstructive pulmonary disease (COPD), pneumonia, lung cancer, deterioration of lung fibrosis or other interstitial lung disease, pneumothorax, pleural effusions, pulmonary embolism, acute heart failure, postoperative breathlessness [8].

### Use oxygen as drug

Consider and use oxygen as a drug. Like any other drug, it has indications, contraindications, dosage, adverse effects, route of administration, methods of delivery etc. So, it should be prescribed, administered and monitored by well trained staff [2]. Ideally the oxygen must be prescribed by registered medical practitioner. The prescription must mention; patient's name, hospital number, fraction of inspired oxygen (FIO<sub>2</sub>), flow rate, target saturation (SaO<sub>2</sub>), delivery system (device) and duration with review time and date [8,9]. The oxygen delivery devices include nasal cannula, facemask, venture cone/valve, non-invasive ventilation, non-rebreathing mask, tracheostomy, invasive ventilation and extracorporeal membrane oxygenation (ECMO) [7].

Oxygen is amongst the major lifesaving drugs but toxic too. So, one must keep the balance between these two effects while prescribing it [9,10]. The recommended oxygen target saturation range in patients not at risk of type II respiratory failure is 94 - 98% and in patients at risk of type II respiratory failure is 88 - 92% [2].

The national oxygen audit conducted by the British Thoracic Society in 2015 revealed that 42% of hospital patients receiving oxygen were following so without an oxygen order. In cases oxygen were ordered, usually the patients did not receive what was specified on the oxygen order. Record showed that significant numbers of patients recording oxygen saturations either below or above the stated target range [11].

### Liberal/conservative use of oxygen

Liberal use of oxygen in an emergency situation is still common [5,12]. Evidence reveals that liberal use of oxygen increases the mortality without improving other patient-related outcomes in acutely ill adults. Hence, supplemental oxygen might become critical if given above SaO<sub>2</sub> range of 94 - 96%. The results of studies support the conservative use of supplemental oxygen [12,13]. The conservative oxygen therapy in mechanically ventilated patients in the intensive care can be practicable and free of adverse consequences while decreasing excess oxygen exposure [14].

### Toxicity of oxygen therapy and titration of oxygen

Oxygen is a drug and it should be given safely to patients like any other medication provided the oxygen is prescribed appropriately and adequately [15]. Excessive oxygen supplementation is commonly seen in mechanically ventilated patients with acute lung injury.

This may be associated with worsening lung function at 48 hours. So, the use of the lowest possible FIO<sub>2</sub> to maintain normoxemia may be justified.

The titration of supplemental oxygen is very essential, but not adequately followed in practice. Both hypoxia and hyperoxia produce detrimental effects at a cellular level [16].

Hyperoxia can induce pulmonary injury and may upsurge oxidative stress [17]. The arterial hyperoxia was found to be independently associated with in-hospital death as compared with either normoxia or hypoxia in ventilated stroke patients admitted to the ICU [18].

A conservative administration strategy for oxygen therapy in which oxygen is titrated to a lower tolerable level is a comparably rational approach in order to prevent iatrogenic harm while preserving adequate tissue oxygenation. The critically ill patients are more prone to develop inflammation, cardiovascular instability, and depleted antioxidant mechanisms. So, the most rational approach may likely be to supply oxygen conservatively and titrate it carefully as per need of the patient [1].

There is association between perioperative administration of a high FIO<sub>2</sub> and increase in long-term mortality [18]. The supplemental oxygen therapy may increase early myocardial injury and is associated with larger myocardial infarct size at 6 months in patients who had ST-segment elevation myocardial infarction without hypoxia [5,20].

British Thoracic Society guidelines states that acutely unwell patients should achieve oxygen saturations between 94% and 98%. Those at risk of hypercapnic respiratory failure should receive restrictive oxygen aiming for saturations of 88%–92%. If this is not adhered to, this may lead to patient harm from either prolonged hypoxemia or hyperoxia in certain patient groups [9].

The harmful effects of oxygen depend on underlying conditions, duration, and degree of the hyperoxic exposure [21,22]. The side effects of oxygen are limited to the lungs in normobaric conditions. But under hyperbaric conditions or when hyperoxia manifests for prolonged periods, then other organs are simultaneously at risk as more oxygen is dissolved in plasma [23].

### Conclusion

Oxygen is a drug and it must be administered safely to the patients like any other drug provided it is prescribed appropriately and adequately by qualified medical practitioner and monitored by trained health professional staff. A conservative administration approach for oxygen therapy in which oxygen is titrated to a lower tolerable level is a comparably rational practice rather than liberal use.

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