Spring 5-5-2023

Hyperoxemia Education to Nurses to Increase the Adherence to Oxygen Weaning Goals in Inpatient COPD Patients.

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Literature Review

Introduction

Oxygen therapy is a common treatment modality for hypoxemic patients, but the target goals for normoxemia are not clearly defined. Consequently, iatrogenic hyperoxemia can occur as a result of too much oxygen therapy. The outcomes from recent clinical research about hyperoxemia show that it can be related to worse outcomes than expected in some critically ill patients. (Pala et al., 2020) Hyperoxemia in acute exacerbation of chronic obstructive pulmonary disease (AECOPD) may lead to adverse outcomes, such as increased hospital stay, mechanical ventilation, and in-hospital mortality from 4% to 9%. (Lim et al., 2019) Often times, the weaning of oxygen during inpatient care relies on the nursing staff. Giving the nursing staff increased education on oxygen weaning to prevent hyperoxemia can enhance adherence to oxygen weaning protocols and decrease the risk of harmful and potentially fatal consequences.

Several recommendations have been updated to monitor peripheral oxygen saturation (SpO2) as an alternate for arterial oxygen saturation (SaO2). In order to prevent hyperoxemia, initiate oxygen only when the lower SpO2 goals are crossed; to titrate the delivered oxygen to maintain SpO2 within a goal range; and to stop administering oxygen when the upper limit of SpO2 has been reached. The lower and upper limits of SpO2 depend on risk factors for oxygen-induced hypercapnia including chronic obstructive pulmonary disease, asthma, and obesity-associated hypoventilation. For patients at risk, oxygen therapy should be initiated when SpO2 is ≤ 88% and discontinued when it is > 92%. For patients without risk factors, oxygen therapy should be initiated when SpO2 is ≤ 92% and discontinued when it is >96%. High-flow oxygen should be saved for use in rare events including carbon monoxide poisoning, cluster headaches, sickle cell crisis and pneumothorax. (Allardet-Servent, Sicard, Metz, & Chiche, 2019)

Aim

This project aims to educate nursing staff on the risks of hyperoxemia to increase observance to oxygen weaning protocols.

Search Strategy

A literature search was performed using EBSCOhost. This search occurred in April 2022. Search terms and phrases included: COPD or chronic obstructive pulmonary disease, hyperoxemia, oxygen weaning, nurse education. Exclusion criteria were any articles published before 2018.

Results

The terms searched were: COPD or chronic obstructive pulmonary disease, hyperoxemia, oxygen weaning, and nurse education. The initial search with the first two terms yielded 9 articles, with 4 of them useful. A second search was undertaken using the first three terms which yielded 0 results. A third search yielded with the first and third term yielded 21 articles with 1 of them useful. Another search with the first two and fourth term yielded 0 results. Another search with the first, third, and fourth term yielded 0 results. Another search with first and fourth term yielded 90 articles most appearing not specific to inpatient. Inpatients or hospitalization or 'hospitalized patients' term was added and narrowed search to 6 articles with 0 of them useful. A last search using the second and fourth terms yielded 1 article. Of the various articles reviewed, a total of 6 manuscripts were chosen for the literature review. One hardship encountered during the literature search was finding articles specifically related nursing education on oxygen weaning protocols to prevent hyperoxemia. A second hardship encountered was that many of the articles found did not offer full text availability.

Hyperoxemia

Hyperoxemia is the condition of higher than normal arterial oxygen levels. Hyperoxemia may lead to adverse outcomes such as increased hospital stay, mechanical ventilation, in-hospital mortality from 4% to 9%, and an increased risk of death. (Cimino, 2018; Lim et al., 2019, Pala et al., 2020; and Ramirez et al, 2020) Another side-effect of hyperoxemia is the increase in arterial CO2, known as oxygen-induced hypercapnia. This complication has been found in patients with chronic obstructive pulmonary disease, asthma, obesity hypoventilation syndrome. Oxygen therapy should be considered potentially harmful in these conditions. There is growing evidence and recent recommendations advising that oxygen should not be initiated before a lower threshold of SpO2 90-92% is met, this threshold for patients at risk of oxygen-induced hypercapnia is SpO2 of <88% without going over the upper limit of SpO2 92% in order to avoid the potentially dangerous effects of hyperoxemia. (Allardet-Servent, Sicard, Metz, & Chiche, 2019) In the latest guidelines, hyperoxemia is defined as SpO2 >94% for the patient population not at risk and >92% for patients at risk including COPD. In most cases, the repeated use of oxygen may have damaging consequences, particularly in patients with trauma or respiratory distress and during myocardial infarction. (Bourassa et al, 2020) These negative effects reveal the reasons it is important to not over oxygenate.

Oxygen weaning protocols

Oxygen weaning practices help a guide to titrate the oxygen concentration based on a patient's need. The idea you cannot give too much oxygen is a fallacy. Supplemental oxygen is a therapy that can be unsafe and lead to hyperoxemia. Oxygen weaning protocols are intended to lead the titration of oxygen therapy to prevent adverse effects and improve outcomes. Following oxygen weaning orders have shown to improve the quality of care as well as decrease the misallocation of resources, resulting in a substantial reduction in mortality. (Ramirez et al, 2020) Several recommendations have been

updated to monitor peripheral oxygen saturation (SpO2) as an alternate for arterial oxygen saturation (SaO2); to initiate oxygen only when the lower SpO2 goals are crossed; to titrate the delivered oxygen to maintain SpO2 within a goal range; and to stop providing oxygen when the upper limit of SpO2 has been reached. The lower and upper limits of SpO2 depend on risk factors for oxygen-induced hypercapnia including chronic obstructive pulmonary disease, asthma, and obesity-associated hypoventilation. For patients at risk, oxygen therapy should be initiated when SpO2 is ≤ 88% and discontinued when it is > 92%. For patients without risk factors, oxygen therapy should be started when SpO2 is ≤ 92% and discontinued when it is >96%. High-flow oxygen should be saved for use in rare events including carbon monoxide poisoning, cluster headaches, sickle cell crisis and pneumothorax. (Allardet-Servent, Sicard, Metz, & Chiche, 2019)

Chronic Obstructive pulmonary disease (COPD)

Oxygen is commonly given during an acute exacerbation of chronic obstructive pulmonary disease (AECOPD) to treat hypoxia. Uncontrolled oxygen administration leads to hyperoxemia. In AECOPD, hyperoxemia may lead to adverse outcomes, such as increased hospital stay, mechanical ventilation, and increase in-hospital mortality from 4% to 9%. (Lim et al., 2019) Patients with COPD can be sensitive to minor elevations in PaO2. During acute exacerbations of COPD, patients can have shortness of breath, dyspnea, and recurrent hypoxemia. Although the administration of oxygen may reduce dyspnea, it may exacerbate hypercapnia and respiratory acidosis. This may lead to increased lethargy and the inability to effectively breathe requiring increased oxygen and positive pressure support device. Also, high flow oxygen in the prehospital setting with confirmed COPD was found to result in one death in every 14 patients treated. (Allardet-Servent, Sicard, Metz, & Chiche, 2019) These adverse side effects demonstrate the dangers of hyperoxemia in this patient population.

Nursing Education

Oxygen therapy is a common supplemental therapy for hypoxemic patients, but the target goals for normoxemia are not always followed. Consequently, iatrogenic hyperoxemia can occur as an adverse effect of too much oxygen therapy. The outcomes from the recent clinical research about hyperoxemia show that it can be related to worse outcomes than expected in some critically ill patients. (Pala et al., 2020) An evaluation of oxygen weaning protocols reported that a significant number of patients in the ICU receiving oxygen, while being monitored with pulse oximetry, did not have the correct oxygen therapy that was ordered for them. Application and adherence to oxygen weaning orders may be contingent on the nursing's awareness of the importance of such practices to warrant patient safety. (Ramirez et al, 2020) The confirmation of harm caused by too much oxygenation is apparent, but the occurrence continues in hospitals. Supplemental oxygen is regularly and generously administered by nursing staff in reaction to a seeming risk of hypoxia, frequently without a provider's order or a recognition of the potential harm. To reduce hyperoxemia, there needs to be an implementation of industry-wide education on the effects to reduce the incidence of related injury to patients and to help lessen the concern among caregivers who worry they are not giving adequate care. (Cimino, 2018) This shows the need for more nursing education to prevent the negative outcomes that can occur with hyperoxemia.

Discussion

Hyperoxemia has the potential to cause severe harm to patients, especially in AECOPD patients who are at higher risk with the goals of O2 saturation significantly lower. The benefits of oxygen therapy should be weighed against the potential negative complications. Unfortunately, nurses in charge of making changes in oxygen concentrations often do not follow the existing oxygen-weaning orders. (Ramirez et al, 2020) The research has shown the adverse outcomes of hyperoxemia including increased

hospital stay to death. Inappropriately, giving too much oxygen can have negative results for patients with risk factors for oxygen-induced hypercapnia. This patient population includes chronic obstructive pulmonary disease, asthma, and obesity-associated hypoventilation. If the patient becomes hypercapnic, they can become lethargic unable to effectively breath. This can lead to increased oxygen and positive pressure support device requirements. Giving too much oxygen can ultimately lengthen the time for patients' meeting the criteria for oxygen weaning and actual weaning patients from oxygen. (Ramirez et al, 2020) Giving nursing staff the proper education to understand the risks of hyperoxemia has the likelihood to increase adherence to oxygen weaning orders and reduce the risk of complicating events related to hyperoxemia.

Conclusion

Establishing increased education to the nursing staff on the risks of hyperoxemia to increase adherence to oxygen weaning protocols has the potential to improve future practice. There is not a lot of information specific to nursing education on weaning oxygen to prevent hyperoxemia in COPD patients. This intervention can improve patient care due to the reduced risk of hyperoxemia. There is a comprehensive body of evidence signifying that hyperoxemia is harmful and can be fatal. Oxygen weaning protocols in place are often not followed for concern of patient care. Nursing and healthcare staff may believe to be helping the patients when in truth they could be potentially harming them. Increased education on hyperoxemia in COPD patients for the nursing staff will assist them in feeling comfortable following oxygen weaning orders to achieve ordered O2 sat goals for their patients.

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