

The use of medical orders in acute care oxygen therapy

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Abstract

The life of every living organism is sustained by the presence of oxygen and the acute deprivation of oxygen will, therefore, result in hypoxia and ultimately death. Although oxygen is normally present in the air, higher concentrations are required to treat many disease processes. Oxygen is therefore considered to be a drug requiring a medical prescription and is subject to any law that covers its use and prescription. Administration is typically authorized by a physician following legal written instructions to a qualified nurse. This standard procedure helps prevent incidence of misuse or oxygen deprivation which could worsen the patient's hypoxia and ultimate outcome. Delaying the administration of oxygen until a written medical prescription is obtained could also have the same effect. Clearly, defined protocols should exist to allow for the legal administration of oxygen by nurses without a physician's order because any delay in administering oxygen to patients can very well lead to their death.

Key words: Drug administration ■ Medical prescription ■ Oxygen therapy

Oxygen is a vital component for all cellular activity and is, therefore, necessary to sustain life (Woodrow, 2007a). Humans must have a constant supply of oxygen in order to survive, consuming 100–140mls every minute for every m² of body surface area (Wilkins, 2005). Neurons, cardiomyocytes, and renal tubular cells in particular, are sensitive to sudden reductions in oxygen supply and are unable to survive prolonged periods of hypoxia. Following cardio-respiratory arrest, hypoxic brain damage may leave a patient incapable of independent life, even if the other body systems survive. Common sense, therefore, dictates that no person, particularly an acutely ill patient, should be denied a substance that is so vital for survival.

Drugs may be defined as chemical substances, which affect the body's functions or alter its physiology (Woodrow, 2007b). Oxygen, therefore, is also often regarded as a drug (Downie et al, 2003) and as with all drugs, its administration is not without potential complications or risks. The published literature, therefore, places a heavy emphasis on the

need for a medical prescription before the administration of supplemental oxygen to a patient. Although this may not be a legal requirement, it is a common requirement in acute care settings. But whether this happens as frequently as it should is questionable. This seems to be an 'international recommendation' as literature published in the UK, USA and Australia refers to the need for a medical order before oxygen administration (Sheppard and Wright, 2006; Bullock et al, 2007; Daniels et al, 2007). The literature, however, frequently fails to address either whether such a prescription applies to every clinical scenario, or the consequences of delaying oxygen administration to patients who are hypoxic because a medical order has not been obtained.

An important part of the nurse's role is to assess for early signs of hypoxia and decide whether there is a need for supplemental oxygen. However, delaying oxygen administration because of the need for a medical order may significantly affect the patient's outcome. The aim of this article is to challenge the basis of the 'prescription only' status of supplemental oxygen and its associated implications for clinical nursing practice.

Benefits and limitations of oxygen therapy

The importance of oxygen as a therapeutic

agent is well recognized in clinical practice. Normally, the 21% oxygen concentration in the air is adequate to meet the metabolic demands of healthy individuals. However, for patients with disturbed cardio-respiratory status or altered metabolic processes, it may be necessary to supply the body with oxygen concentrations greater than that in ambient air. This is to maintain aerobic metabolism and normal cellular function (Woodrow, 2007a).

Supplemental oxygen therapy is primarily used for correcting mild to moderate hypoxaemia in order to prevent hypoxia, while minimizing cardiopulmonary effort (Heuer and Scanlan, 2003). More broadly, supplemental oxygen is used in response to several conditions which may induce hypoxia (Price, 2007). Common examples include chronic obstructive pulmonary disease (COPD), asthma, pulmonary embolism, and conditions which compromise cardiac output, such as myocardial infarction, cardiac or respiratory arrest, and septic shock. It is also used peri-operatively, when anaesthetic agents and opioids, such as morphine, which could precipitate respiratory depression, are administered (Kitcatt, 2005), or to avoid myocardial ischaemic events (Cooper et al, 2007).

Supplemental oxygen therapy is also beneficial in preventing anaerobic cellular metabolism, acidosis, electrolyte shifts, and arrhythmias, which can occur with de-saturation below 90% (Gulanick and Myers, 2007).

Hazards and misconceptions

Oxygen therapy obviously has undoubted benefits, but the literature also suggests that it can be harmful and much has been published on the associated complications. One prominent complication is induced hypoventilation with resultant hypercapnia (where there is too much carbon dioxide (CO₂) in the blood. This can occur in some patients with COPD (Woodrow, 2007a; Sheldon, 2008), acute drug overdoses (particularly, heroin, narcotics and barbiturates) (Epstein and Singh, 2001), and in unconscious patients. In patients with normal blood oxygen levels,

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fluctuating carbon dioxide levels serve as the main stimulus to breathe, but for individuals with long-standing impaired gas exchange (e.g. COPD), this mechanism may be lost and these patients instead rely on low oxygen levels as the major stimulus for breathing.

This 'hypoxic drive' is of concern when excess supplemental oxygen is administered as some authors believe it could inadvertently switch off some patients' stimulus to breathe (Downie et al, 2003; Ellis and Bentz, 2007; Woodrow, 2007a; Sheldon, 2008). This has created the widespread belief that these patients should not be given more than 28% oxygen due to the fear that respiration may cease altogether (Woodrow, 2007a). However, the patient is more likely to die from hypoxaemia well before hypercapnia occurs (Therapeutic Guidelines Committee, 2005), as a low oxygen flow rate may be inadequate to treat the hypoxia (Barnett, 2007a).

Therefore, if patients are still hypoxic despite receiving 28% supplemental oxygen, their oxygen needs clearly are not being met. Numerous authors suggest that only a small proportion of patients with COPD are dependent on a degree of hypoxia to drive their respiratory effort (Barnett, 2007b). Furthermore, some patients with COPD have reasonably normal physiology, which may account for the results of some studies in which the PaCO₂ (partial pressure of carbon dioxide in arterial blood) did not considerably alter even when COPD patients were subjected to high concentrations of oxygen (Cooper et al, 2007).

Contrary to the debate that oxygen therapy commonly induces hypercapnia among some patients, Cooper et al (2007) assert that it is the patient's acute illness (e.g. 'tired' asthmatics; the morbidly obese with concurrent pneumonia; patients with acute respiratory distress syndrome), which causes the ventilatory failure that results in hypercapnia. In other words, it is not the oxygen therapy but the underlying disease process that is responsible.

Instead of focusing on predetermined concentrations or flow rates of inspired oxygen, some authors state that the aim in patients with COPD should be a specific SaO₂ (oxygen saturation of arterial blood) range, since these patients are tolerant of moderate chronic hypoxaemia (Plant et al, 2000; Thomson et al, 2002; Therapeutic Guidelines, 2005). This is opposed to the clinical practice of delivering a prescribed amount of oxygen, regardless of the patient's saturation or oxygen

delivery. The literature also describes a number of other consequences associated with the administration of very high fractions (0.4 or greater) of inspired oxygen (FiO₂). These consequences are outlined below.

Oxygen toxicity

Prolonged exposure to a high PaO₂ (partial pressure of oxygen in arterial blood) is believed to be harmful to lung tissue (Sheldon 2008). Examples of harm include damage to the alveolar-capillary membrane, acute tracheobronchitis, depressed mucociliary function and impaired clearance of mucus (Pierce, 2007; Urden et al 2006). Manifestations of oxygen toxicity include (Biddle, 2008):

- Bronchitis
- Dyspnoea
- Chest discomfort
- Decreased levels of consciousness
- Seizures.

Findings of many studies suggest that the human lung can withstand breathing oxygen levels of up to 50% without inflicting major lung damage (Heuer and Scanlan, 2003). Others believe that oxygen concentrations of greater than 60% maintained over a duration of more than 48 hours may damage the lung's alveolar membrane (Downie et al, 2003; Biddle, 2008).

However rather than setting specific parameters to preclude oxygen toxicity, the FiO₂ and duration of oxygen delivery are the two valuable factors that need to be taken into account when administering oxygen (Heuer and Scanlan, 2003). The general guide in the literature is that oxygen administration should be restricted to less than 24 hours when possible and that exposing a patient to a high FiO₂ is acceptable (and often necessary) provided that the concentration is reduced to 70% within two days and 50% or less in five days (Heuer and Scanlan, 2003). This is due to the risk of denitrogenation atelectasis (see below). However, for acutely or critically ill patients, reducing their FiO₂ after a few days may worsen their condition and ultimately be fatal.

Denitrogenation or absorption atelectasis

Nitrogen plays a vital role in keeping the alveoli expanded, considering that ambient air contains approximately 79% nitrogen. When a person breathes 100% oxygen, the residual nitrogen is washed out of the alveoli and replaced with pure oxygen (Heuer and Scanlan, 2003; Woodrow, 2006). The risk of alveoli collapse, therefore, increases with a FiO₂ greater

than 50% (Heuer and Scanlan, 2003). Nurses working in intensive care may try to limit prolonged exposure to supplementary oxygen to less than 60%, claiming that short periods of exposure to high oxygen concentrations do not seem to inflict any harm to the patient (Woodrow, 2006). However, as described, higher FiO₂ are often required due to the severity of the patient's illness.

Retinopathy of prematurity

Retinopathy of prematurity is a potentially blinding disease that occurs because the retina is immature before 34 weeks gestation (Coe, 2007). The high arterial oxygen tension resulting from supplemental oxygen delivery causes obliteration of developing retinal vessels leading to blindness. But debate exists about whether the length of time oxygen is delivered affects the incidence or severity of the disease (Wheatley et al, 2002). At least one study has shown a decrease in the incidence of retinopathy of prematurity with improved oxygen management practices (Chow et al, 2003).

Summary

Despite all the serious adverse effects associated with supplemental oxygen administration, the alternative is death due to tissue hypoxia. The literature, however, commonly fails to address this converse argument. Reinforcing to clinicians that the administration of oxygen requires a medical order will not prevent oxygen mishaps from happening, as errors with oxygen administration are evident in clinical practice (Dodd et al, 2000).

Rather, it should be highlighted that supplemental oxygen administration demands sound clinical judgement, and therefore an awareness of the limitations associated with its administration. The British Thoracic Society (2008) recently recommended that in most emergency situations oxygen should be given to patients immediately without a formal prescription and that the lack of a prescription should never prevent oxygen being delivered.

Oxygen classification

It therefore needs to be asked whether oxygen therapy should continue to be restricted as a 'prescription-only' drug, giving nurses limited freedom in its administration. Even if oxygen's administration is restricted in this way, in clinical practice nurses often administer it without a medical order due to the patient's obvious need (though this may be in breach of hospital guidelines). Furthermore, oxygen can be administered by non-health-care professionals,

such as life-savers and airline hostesses. It could, therefore, be argued that oxygen should be classified as a nurse-initiated medication, one that is approved by the employing hospital to be administered by a registered nurse without a physician's authorization.

However, patients who require a sudden increase in their FiO₂ should obviously be assessed by a physician shortly afterwards. A standing order allows nurses to administer medications to patients without a formal prescription by a physician. This is different to a PRN order, which is prescribed for a specific patient when needed. A standing order is of particular value in remote areas, where it may be common practice for nurses to assume the responsibility for prescription and administration of some drugs owing to a lack of medical staff.

Should oxygen be universally classified as a standing order in acute settings, with clear-cut clinical guidelines to foster consistency in practice? It would seem logical that if a patient's respiratory function is such that she is hypoxic, the nurse should be able to promptly administer oxygen, titrating the rate of flow to maintain oxygen saturation levels at or above 90% without fear that she is practising outside the legal framework that governs the profession.

Even if they were practising outside the legal boundaries of the profession, hypoxic patients should still be given oxygen as soon as possible. Whether a nurse decides to make an emergency telephone order or call for emergency medical assistance before administration, a standing order still needs to be reviewed by a medic, usually requiring that it be countersigned within 24 hours. However, at least, a standing order is not as restrictive as the 'prescription-only' status of oxygen. A standing order avoids any anxiety and confusion on the nurse's part when administering this drug.

Adverse events related to respiratory dysfunction have commonly been reported in the literature, for example, Considine (2005) stated that many adverse events could have been prevented if hypoxaemia had only been corrected early on. One potentially life-saving intervention is the ability of the nurse to observe and interpret manifestations of oxygen deficiency and administer supplemental oxygen in accordance with the patient's needs.

However, it is paramount that nurses acknowledge that oxygen, like analgesics, only serves as a temporary intervention and that the underlying cause of hypoxaemia needs to be identified and corrected. Nurses also need to take responsibility for maintaining and updating their

contemporary knowledge of the medications they administer, including oxygen.

Conclusion

Oxygen is a gas that is essential for maintaining the body's metabolic processes. As it has a cellular effect, oxygen can also be labelled as a drug. Much of the published literature states that oxygen must only be administered with a medical order, though this may result in a worse outcome for the patient. Although there are risks associated with oxygen administration to acute patients, the risks of not providing oxygen are far greater. Nurses should not withhold oxygen therapy for fear of oxygen-associated complications. Published guidelines for oxygen administration should be based on sound research evidence, not ritual, anecdote or historical practices.

In the author's opinion, nurses should have the authority to administer oxygen without a medical order. However, when nurses do this, they should not perceive it as a cure for the patient's clinical problem. The initiation of oxygen therapy or an increase in the oxygen the patient is currently receiving, should be complemented with clinical assessment by a medic, as well as evidence-based nursing care. **BJN**

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KEY POINTS

- Oxygen as a drug should be carefully considered in its use as a medication for some illnesses.
- Oxygen is an effective therapeutic agent but in some circumstances can be harmful to patient.
- The ability of a registered nurse to assess a situation that calls for the use of oxygen based on correct observations could improve the patient's outcome.
- Policies on oxygen administration differ widely between different institutions. Standardization is an urgent requirement to avoid variations in practice and evidence-based practice should be promoted.
- Nurses should not delay oxygen administration due to a lack of a medical prescription or for fear of harming the patient.
- Written guidelines should not solely emphasize the prescription-only status of oxygen but instead reflect the need for skilled nursing judgement in oxygen administration.

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