

Hospital Peer Review

May 2008

Hospital Peer Review is a monthly newsletter sponsored by the Rural Healthcare Quality Network to alert Critical Access Hospitals regarding findings from the Peer Review Program. Summarized are a few of the key findings and best practices that would be helpful for other critical access hospitals to be knowledgeable about. This newsletter is edited by Myron Bloom, Medical Director and he can be reached at dmbloom@msn.com

Oxygen is a dangerous drug

Oxygen should be considered a dangerous drug and therefore orders for supplemental oxygen should specify: dosage, duration, method of administration with treatment goals and monitoring of clinical measures.

- Oxygen is best prescribed to achieve a desirable target range rather than a fixed dose of oxygen.
- For most COPD patients, a target saturation range of 88%-92% will avoid the risks of hypoxia and hypercapnia; target 88-90% in cases of CO₂ retention and 90-92% in the absence of CO₂ retention.
- Oxygen tensions above 50 mm Hg (saturation above 85%) will protect patients from hypoxic injury during exacerbations of COPD.
- Oxygen tensions above 70 mm Hg (saturation above 94%) are associated with increased risk of hypercapnia and acidosis in exacerbated COPD.

While hyperbaric oxygen can induce seizures and the chronic inhalation of high oxygen concentrations may result in pulmonary oxygen toxicity ranging from mild tracheobronchitis to diffuse alveolar damage, which is histologically indistinguishable from acute respiratory distress syndrome (ARDS). Chronic lower level oxygen concentrations may result in mucous plugging, absorptive atelectasis, increased mismatch between ventilation and perfusion within the lung which impairs elimination of carbon dioxide and thus leads to acidosis. Hyperoxia may also increase susceptibility to secondary infection by impairing both mucociliary clearance and the bactericidal capacity of immune cells. The currently recommended target oxygen tension in exacerbated COPD is about 60-65 mm Hg, which is equivalent to a saturation of approximately 90%-92%

Titrating oxygen appropriately in exacerbations of COPD is challenging as patients in this setting can be harmed by too much or too little oxygen. A review of the literature suggests that most patients with exacerbated COPD are adequately oxygenated if the oxygen tension can be maintained above 50 mm Hg, corresponding to an oxygen saturation above about 85% (in contrast to people without COPD who require oxygen levels above 60 mm Hg or 90%).

A study of 972 COPD patients showed that almost half were hypercapnic on arrival in the emergency department, one fifth were acidotic (pH below 7.35), and 4.6% were severely acidotic with pH below 7.25. Patients with the highest blood oxygen tensions had the worst acidosis, supporting the premise that excessive oxygen can lead to respiratory acidosis in this setting. More than half of the patients with PaO₂ above 75 mm Hg were acidotic. Based on their findings, the authors recommended keeping the oxygen saturation below 92% to avoid this risk. Another

study demonstrated that an oxygen tension above 74.5 mm Hg in patients with acute flare of COPD was associated with an increased risk of requirement of NIPPV and greater length of hospital stay.

The new British Thoracic Society Emergency Oxygen guideline for the United Kingdom will recommend that the saturation should be maintained above 88% in most cases of exacerbated COPD to allow an additional margin of safety. However, high-risk patients with a history of prior hypercapnic respiratory failure may be safely managed with oxygen saturation in the range of 85%-88%.

Based on these studies, the UK Emergency Oxygen Guideline will recommend a target oxygen saturation range of 88%-92% for most patients with exacerbated COPD and for patients with a history of respiratory acidosis a lower target range of 85%-90%. The UK Emergency Oxygen Guideline will recommend that the initial treatment for patients with exacerbated COPD should be a 28% Venturi mask at 4 L/minute dropping to a 24% Venturi if the saturation rises above 92%. Blood gases should be checked in all such cases on arrival in the emergency department, and NIPPV should be instituted if the patient is acidotic (pH below 7.35).

Approximate Relationship Between Arterial Hemoglobin Oxygen Saturation and Arterial Oxygen Tension in mm Hg at Normal pH

Oxygen tension (mm Hg)	50	55	60	65	70	75	80	85	90	95	100	105	110
Oxygen saturation (%)	85.1	88.3	90.7	92.4	93.8	94.9	95.7	96.6	97.0	97.5	97.9	98.2	98.4

Murphy R, Driscoll P, O' Driscoll R. Emergency oxygen therapy for the COPD patient. *Emerg Med J.* 2001;18:333-339.

Plant PK, Owen JL, Elliott MW. One year period prevalence study of respiratory acidosis in acute exacerbations of COPD: implications for the provision of non-invasive ventilation and oxygen administration. *Thorax.* 2000;55:550-554.

O'Driscoll BR, Howard L, Davison AM. British Thoracic Society. Guideline for emergency oxygen use in adult patients. *Thorax.* 2008:In press.

Action Points

- **Review and revise existing oxygen administration policies and procedures.**
- **Adopt supplemental oxygen policies with a specified upward and downward titration methodology that specifies minimum and maximum oximetry goals for different patient populations (COPD) rather than flow rates, except for short application time periods in specific acute patient situations (ACS, CVA, immediate postoperative patients, etc.).**
- **Separate the functions of oximetry monitoring and adjustment of supplemental oxygen therapy with separate competency skills required.**
- **Monitor transcutaneous oximetry, venous bicarbonate, pH and arterial gases prudently, especially in cases of COPD exacerbation or when expected clinical benefits from supplemental oxygen therapy have not been attained.**