

A Quick Reference on Hypoxemia

Jonathan Bach, DVM

KEYWORDS

• Respiratory distress • Ventilation • Blood gas • Pulse oximetry

KEY POINTS

- Hypoxemia can arise from a wide range of causes and can be life threatening.
- Thoughtful treatment and diagnostic approaches are important to help minimize patient deterioration and optimize the patient's chances of recovery.
- Documentation of hypoxemia, although valuable, is not always possible because some patients are highly unstable.

INTRODUCTION

Hypoxemia can be a life-threatening condition that warrants prompt identification, treatment, and logical diagnostics. Clinicians should be familiar with the manifestations of hypoxemia and be able to quickly localize the anatomic region from which the patient's hypoxemia is arising. Serial documentation of hypoxemia provides a valuable monitoring tool for patient management. Emergency patients with severe respiratory distress may require emergent treatments or interventions to avert a crisis situation, including cardiopulmonary arrest.

ANALYSIS

- Documentation of hypoxemia commonly occurs via 1 of 2 methods: pulse oximetry or arterial blood gas analysis.
 - Arterial blood gas analysis is the gold standard and allows measurement of plasma partial pressure of oxygen (P_{aO_2}). Normal P_{aO_2} is greater than 80 mm Hg. Hypoxemia is defined as P_{aO_2} of less than 80 mm Hg, and severe hypoxemia is a P_{aO_2} less than 60 mm Hg.^{1,2}
 - Major advantages of the arterial blood gas include assessment of partial pressure of carbon dioxide (P_{aCO_2}) and ventilatory status, and acid-base

Disclosure: The author has nothing to disclose.

Department of Medical Sciences, University of Wisconsin-Madison, 2015 Linden Drive, Madison, WI 53706, USA

E-mail address: jon.bach@wisc.edu

Vet Clin Small Anim ■ (2016) ■–■

<http://dx.doi.org/10.1016/j.cvsm.2016.10.004>

0195-5616/16/© 2016 Elsevier Inc. All rights reserved.

vetsmall.theclinics.com

assessment. Most blood gas analyzers afford additional measurements, including electrolytes, lactate, and glucose.

- Correct handling is imperative to avoid inaccurate measurements. Delay in analysis allows continued metabolism by the erythrocytes and reduces PaO_2 . Keeping the specimen on ice allows accurate measurement to be delayed for up to 1 hour. Air bubbles in the sample introduce error and cause an increase in PaO_2 .
- Arterial blood gas collection is mild to moderate in difficulty, and is further described elsewhere.³ If clinicians are uncertain whether a sample is arterial, a venous sample from the cephalic or saphenous vein can be collected and compared; PaO_2 on a venous sample is substantially lower than from an arterial sample.
- The alveolar-arterial (A-a) gradient can be calculated from arterial blood gas and may aid in differentiating the causes of hypoxemia. A normal A-a gradient is less than 15 to 25 mm Hg. The A-a equation reads: $\text{A-a} = (150 - \text{PaCO}_2/\text{RQ}) - \text{PaO}_2$
 RQ is the respiratory quotient, which most commonly is 0.8.¹
- Pulse oximetry provides continuous measurement of oxygenated hemoglobin using 2 wavelengths of light (660 and 940 nm). Pulse oximetry values on ambient air of 21% oxygen are normally greater than 95%. Values between 90% and 94% indicate mild to moderate hypoxemia, and values less than 90% indicate severe hypoxemia. Because of the sigmoidal shape of the hemoglobin oxygen dissociation curve, pulse oximetry is insensitive for hypoxemia when patients are receiving supplemental oxygen.^{1,2} Pulse oximetry does not provide information about ventilatory status.
- Pulse oximetry is prone to artifactual readings. Those result mostly from motion, vasoconstriction, hypothermia, or tissue pigmentation. Users should ensure that the heart rate on the oximeter matches the patient's heart rate and the oximeter is detecting a signal of good quality. Preferred sites for measurement include mucous membranes (eg, tongue, lip, prepuce, vulva); if skin folds are used, more distal sites are prone to underestimating oxygenation and may result in erroneous assessment of hypoxemia.⁴
- CO oximetry is a third option for assessing hypoxemia, and is typically used in research or academic settings. In addition to measuring SpO_2 , carboxyhemoglobin and methemoglobin are also measured.⁵

CAUSES

The classic causes of hypoxemia may be ascribed to the 5 following mechanisms. However, more than 1 cause typically contributes to hypoxemia:

- Hypoventilation: when a patient has hypoventilation, the PaO_2 and PAO_2 decrease to a similar degree to the PaCO_2 , whereas alveolar CO_2 increases. Because of these opposite and nearly equal changes, the A-a gradient does not increase. If an increase in A-a gradient is present in a patient with hypoventilation, concurrent diffusion impairment, ventilation/perfusion (V/Q) mismatch, or right-to-left shunting is present. Causes of hypoventilation include centrally acting respiratory depressants, neuromuscular diseases inhibiting the muscles of respiration, chest wall injuries, pleural space lesions, and upper airway obstruction.
- Decreased fraction of inspired O_2 (FiO_2): the most common cause of decreased FiO_2 is decreased barometric pressure associated with high altitude or anesthetic error, such as a low O_2 supply source or administration of nitrogen oxide without

Download English Version:

<https://daneshyari.com/en/article/5544611>

Download Persian Version:

<https://daneshyari.com/article/5544611>

[Daneshyari.com](https://daneshyari.com)