

“Pearls”
of
Veterinary Medicine



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AT A GLANCE

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CRITICAL CARE

Oxygen Therapy & Monitoring Oxygenation

Oxygen therapy is the primary treatment for various conditions including noncardiogenic pulmonary edema (see on page 3). The goal of oxygen therapy is to maintain adequate blood oxygen levels while avoiding hyperoxia, **targeting a PaO₂ of 80–140 mm Hg or a SpO₂ of 95–99%.** Hypoxemia is defined as PaO₂ <80 mm Hg or SpO₂ <95%, with severe hypoxemia being PaO₂ <60 mm Hg or SpO₂ <90%.

The gold standard for monitoring oxygen levels is measuring the partial pressure of oxygen in arterial blood (PaO₂) through invasive blood gas tests and calculating a P/F ratio (PaO₂/FIO₂). Alternatively, SpO₂ (% saturation of O₂) can be measured with a pulse oximeter. By calculating the S/F ratio (SpO₂/FIO₂), the severity of the lung injury can be assessed, and an estimate of the oxygen concentration needed to maintain a SpO₂ >95% can be made. For example, a normal pulse ox of 95%/0.21 (21% oxygen in room air) = S/F of 452

Assessing lung injury based on P/F and S/F ratios:

| | Normal | Acute Lung Injury | ARDS |
|-----------------|--------|-------------------|----------|
| P/F | >400 | ≤300 | ≤200 |
| S/F (2 studies) | ~452 | ≤296-315 | ≤235-236 |

Commonly used methods of oxygen supplementation provide varying levels of FIO₂:

Flow-by Oxygen: Delivers an FIO₂ of 25–45%.

Face Mask: Can achieve FIO₂ of 50% or higher, but most patients only tolerate masks for short periods of time.

Oxygen Hoods: Can be purchased or made by covering an e-collar with clear plastic leaving a window for ventilation. Hoods provide 30–40% FIO₂ at flow rates of ~1–2 L/min and 50–60% at higher flow rates. Adequate ventilation is necessary to prevent heat and CO₂ buildup.

Nasal Prongs: Typically, adult human nasal prongs are used in medium- and large-breed dogs, delivering an FIO₂ of 30–50% depending on the flow rate.

Nasal Catheters: A soft catheter with multiple holes is placed in the ventral meatus of the nose, with the tip advanced to the level of the lateral canthus of the eye. Bilateral catheters can be used for higher FIO₂ levels, but higher flow rates may not be well-tolerated. This method is not always suitable for cats or brachycephalic dogs. See the chart below for the approximate FIO₂ achieved.

Oxygen Cages: Can achieve 40-60% FIO₂

Mechanical Ventilation: Indicated if the methods mentioned above are **unable to maintain PaO₂ <60 mm Hg or SpO₂ <90%, if PaCO₂ >60 mm Hg**, or in cases of severe fatigue, respiratory distress, or risk of respiratory arrest.

Oxygen flow rates and associated FIO₂ for nasal oxygen catheters⁴

| O ₂ flow rate (ml/kg/min) | Appr. FIO ₂ achieved |
|--------------------------------------|---------------------------------|
| 50—1 catheter | ~30% |
| 100—1 catheter | ~37% |
| 200—1 catheter | ~58% |
| 200—bilateral catheters | ~77% |

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