Respiratory Emergencies - Helping our patients catch their breath

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Defining terms
<table>
<thead>
<tr>
<th>Hypoxia</th>
<th>Hypoxemia</th>
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<tr>
<td>● Whole body or region of the body is deprived of adequate oxygen supply</td>
<td>● Decrease in the amount of oxygen dissolved in the blood</td>
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<td>● Think <em>emia</em> = blood</td>
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<td>Hypocapnia</td>
<td>Hypercapnia</td>
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<td>Lower than normal levels of carbon dioxide in the blood</td>
<td>Higher than normal levels of carbon dioxide in the blood</td>
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<td>Hyperventilation</td>
<td>Hypoventilation</td>
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<td>SpO2</td>
<td>PaO2</td>
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<td>● Non-invasive measurement of peripheral capillary oxygen saturation</td>
<td>● Partial pressure of oxygen dissolved in plasma&lt;br&gt;● Indicates oxygen available in alveoli that can be dissolved in the blood&lt;br&gt;● Does not measure total body oxygen content</td>
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<td>○ Pulse oximetry</td>
<td>○ Blood gas</td>
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Do your numbers make sense?

PaO2 should be = FiO₂ x 5

- At room air FiO₂ is 21%
  - 21 x 5 ≈ 100 mmHg (what PaO₂ should be)
- Under anesthesia FiO₂ is 100%
  - 100 x 5 = 500 mmHg (what PaO₂ should be)
Let’s talk cyanosis
Cyanosis

- Blue to purple color of tissues
- Deoxygenated hemoglobin
- Central vs. peripheral
- Indicates **severe** hypoxia
- When do we see cyanosis in a patient with a *normal* PCV?
  - SaO2 of 73-78%
  - PaO2 of 39-44 mm Hg
- Will take much lower SaO2 and PaO2 before cyanosis is seen in anemic patients
Handling the dyspneic patient
Living on the edge

- Stress can cause decompensation that could lead to respiratory distress
- Cats can compensate in a non-stressful environment to a point...
- No patient should die in radiology
- Diagnostics may have to wait

Minimize stress

- Toweling techniques for cats
- Do not hold mouth closed for auscultation
- Consider e-collar for protection if fractious
- Sedation for panicked patients
  - Prepare to intubate
Minimize stress

- Perform treatments/diagnostics in stages if needed
- Form a game plan with your support staff
  - What do you want to accomplish?
  - How do you think the patient will respond to treatment?
  - Let them know what signs will tell you the patient has had enough
  - Listen to their concerns
Oxygen delivery methods

- Flow by
- Mask
- Oxygen hood
- Oxygen cage
- Incubator
- Oxygen e-collar
- Nasal oxygen line
- Nasotracheal oxygen line
- Intubation
Initial Stabilization

- Oxygen supplementation
- Ensure patent airway
- Intravenous catheter
- Pain medication if indicated
- Sedation for animal who are panicked
- Induction and intubation if in severe distress
- Prepare for chest tap if pleural effusion or pneumothorax are suspected
Breathing patterns
Breathing patterns

- Normal
- Inspiratory effort
- Expiratory effort
- Paradoxical
Normal

- Relies almost entirely on the diaphragm
- Almost undetectable
- Expiration is passive
Inspiratory effort

Clinical signs

- Noisy
- Slow, deep breaths
- Open mouth breathing
- Neck and head extended
- Commissures of the lips extended
Inspiratory effort

Possible causes

- Usually upper airway disease
  - Obstructed nares
  - Elongated soft palate
  - Laryngeal paralysis
  - Pharyngeal or laryngeal edema
  - Airway obstruction
Expiratory effort

Clinical signs

- Wheezing
- Deep breaths with active abdominal component
- Normal to slow respiratory rate
Expiratory effort

Possible causes

- Usually lower airway disease
  - Pulmonary parenchymal disease
  - Asthma
  - Bronchial abnormalities or inflammation
Paradoxical breathing

Clinical signs

- Chest wall moves inward during inhalation rather than expanding outward
- At the same time the abdomen appears to increase in volume
  - Due to the displacement of the abdominal components by the contraction of the caudal ribs
Paradoxical breathing

Possible causes

- Flail Chest
- Pleural space disease
  - Pleural effusion
  - Pneumothorax
Advanced procedures
Nasal oxygen catheter
Nasal oxygen catheter

Benefits

- Allows easy access to the patient without disrupting oxygen delivery
- Effective
- Supplies are readily accessible at most clinics
- Relatively inexpensive
- Usually well tolerated
Nasal oxygen catheter

Possible complications

- Nasopharyngeal mucosa trauma from high flow rates
- Gastric distention
- Epistaxis
Nasotracheal oxygen catheter
Nasotracheal oxygen catheter

Benefits

- Effective for patients with upper airway disease or tracheal collapse
- High FiO2 can be achieved with very low flow rate
- Relatively inexpensive
- Allows easy access to the patient without disrupting oxygen delivery
Nasotracheal oxygen catheter

Possible complications

- May not be tolerated as well as nasal oxygen catheter
- May irritate the trachea causing the patient to cough
- Patient requires sedation for placement
- Risk of aspiration
  - Cannot eat or drink
Nursing Care
Nursing care

- Stress free environment
- Encourage sternal recumbency
- Humidify oxygen
- Encourage movement for patients with pneumonia
- Allow for eliminations
  - Walk on oxygen if able
- Creature comforts
Nursing care

- Monitor body temperature
  - Adjust environmental temperature accordingly
- Frequently reassess patient status
- Compare readings from monitor to how the patient looks clinically
- Communicate concerns and changes to clinician no matter how minor you think they are
Critical care ventilation
When should we ventilate?

- Severe hypoxemia despite therapy
- Severe hypoventilation despite therapy
- Excessive respiratory effort with signs of patient fatigue and worry of respiratory failure
- Severe respiratory distress causing patient panic
What is the benefit?

- Normalizing oxygenation
- Normalizing CO2 levels
- Prevention of respiratory failure
- Opening up collapsed alveoli
- Allowing damaged lungs time to heal without having the patient struggle to breathe
Possible complications

Cardiovascular compromise due to impaired venous return due to positive pressure in the chest

- Positive intrathoracic pressures created by the ventilator collapse the caudal vena cava
Possible complications

Upper airway complications

- Sinusitis
- Pharyngitis
- Tracheal necrosis
- Airway occlusion from mucous or blood
Possible complications

Lower airway complications

- Pneumothorax from overinflation
- Ventilation-acquired pneumonia
Possible complications

Renal complications

- Decreased glomerular filtration rate
- Decrease urine output
- Water and sodium retention