Acute Respiratory Emergencies

Marie E. Kerl DVM, MPH
DACVIM, DACVECC

The Emergency Respiratory Animal

- Acute presentation
- Acute OR chronic disease
- Fragile!!!
- Time of the essence
- Owners don’t understand

Rule No. 1: STEP AWAY FROM THE PATIENT!
(Hands-off observation first!)

- Tachypnea = hypoxemia?
  - Also: fear, pain, hyperthermia, CNS, metabolic acidosis, hypercapnia, hypotension, inhaled irritants, interstitial lung disease
- Hypoxemia = other clues?
  - “Dyspnea” = People
  - Orthopnea = body position
  - Cyanosis = Blue mucous membranes
  - Stertor = Nose
  - Stridor = Upper airway
  - Chest excursions normal?
  - Abdominal wall movement?
  - Normal inspiratory/ expiratory ratio?
**Rule No. 2:**
Dyspneic animals panic
- Examine with caution = Gather information without harm
  - Hands-off observation
  - Oxygen
  - Quiet environment
  - ABC’s
  - Light sedation?

**Rule No. 3:** Oxygen may not help, but it hardly ever hurts.
- Noninvasive:
  - Flow-by
  - Face mask
  - Oxygen hood
  - Oxygen cage
- Invasive:
  - Nasal/nasopharyngeal
  - Transtracheal

**Question:**
- What are the benefits and risks of supplemental oxygen therapy?
- How much benefit does supplemental oxygen therapy provide to blood oxygen content and tissue oxygen delivery?
  - \( \text{CaO}_2 = (\text{Hb} \times 1.39 \times \text{SaO}_2) + (\text{PaO}_2 \times 0.003) \)
- Which oxygen delivery methods reach 30% concentration? 40% concentration? >40%?
Flow-by Oxygen: ~30% FiO2

Oxygen Delivery Methods: ~ 40%

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Rule No. 4:
No Radiographs Until Stable.
• Other diagnostics?
  – SpO2/ PaO2
  – PaCO2, PvCO2
  • Ventilatory failure
  – Chest ultrasound (T-FAST)?
    • Fluid or air?
  – Diagnostic thoracocentesis?

"Acute" Trauma: 6 Y/O M/C Boxer
• HBT (truck)
• Dog in respiratory distress
• Owner drove 3 hours to MU
• At arrival –
  – Severe respiratory distress, rapidly deteriorating (~10 min)
  – Poor air movement
  – Tachypnea, cyanosis
  – Coughing / spewing blood
  – Markedly increased lung sounds
• Plan?
Rule No. 5: It is much easier to keep an animal breathing than it is to “re-animate”.

- Respiratory failure imminent?
  - Capture airway
- IV catheter first!
- Have supplies ready
- Propofol induction
- Intubation
- Ambu-bag
- Dump airway fluid

Managing Acute Upper Airway Obstruction

- Emergency endotracheal intubation (rapid anesthesia)
- Intratracheal oxygen
- Tracheostomy

Airway Suction
Rule No. 6: Meet the owner promptly
- Emergency = Scary!
- Rapid deterioration
- Keep it simple
- Owner permission
- ICU visit?

What Defines Respiratory Failure?
- PaO₂ < 60 mm Hg when FiO₂ < 0.5
- PaCO₂ > 50 mm Hg

Mechanisms of Respiratory Failure
- Ventilation Failure: pCO₂ increased
  - CNS
  - Neuropathy/Myopathy
  - Upper Airway Obstruction
  - Pleural Space Disease
- Oxygenation Failure: PaO₂/SpO₂ Decreased
  - Diffusion Impairment
  - Ventilation-Perfusion Mismatch
Ventilation Failure: Neurologic Causes

- Severe CNS Depression: Head trauma
- Cervical Spinal Cord: C 5, 6, 7
- Peripheral neuromuscular

Ventilation Failure: Structural Abnormality

- Chest Wall
- Larynx
- Pleural Space
- Trachea

Oxygenation Failure: Lung Abnormality

- Pulmonary contusions
- Pneumonia/ Pneumonitis
  - Aspiration, Hematogenous
- Pulmonary hemorrhage
- Pulmonary thromboembolism
- Smoke inhalation
- Interstitial lung disease

Poor Prognosis
Mechanisms of Pulmonary Edema

Increased pressure = Cardiogenic
Increased permeability = Vascular leak (e.g. Non-cardiogenic, Neuregenic)

- Underlying cardiac disease
- Fluid overload (iatrogenic)
- Sepsis
- ARDS: 2nd Any critical illness
- Drowning, strangulation, electrocution, contusions

Treatment: Ventilation Failure (PCO2 increase)

- Oxygen therapy alone does not correct ventilation failure
- Upper Airway Obstruction
  - Fixed (Foreign body, mass)
    - Intubate or Tracheostomy, remove obstruction if possible
  - Dynamic (Laryngeal paralysis, Tracheal collapse)
    - Very mild sedation (low-dose acepromazine 0.025 mg/kg)
    - +/- low-dose butorphanol
- Excessive sedation/ anesthesia
  - Reverse drugs, ventilate

Persistent Air or Fluid in the Chest?
- Thoracocentesis
- Continuous/ intermittent thoracic drainage
When to consider thoracostomy tube?

- Pneumothorax: Persistent without endpoint, or recurrent > 2 times
- Fluid: Unable to keep chest evacuated

3-Chamber System

How Continuous Thoracic Drainage works:
Ventilation Failure: Neurologic Disease

- Intubate / ventilate
- Correct underlying problem if possible
  - Not always possible

Treatment: Hypoxemic Failure

- Pulmonary edema from congestive heart failure
  - Acute medical management for heart failure
- Pulmonary contusions / non-cardiogenic pulmonary edema
  - Oxygen therapy >40%
  - Conservative fluid therapy!
  - Watch for respiratory fatigue and failure
  - Mechanical ventilation

Treatment: Hypoxemic Failure

- Pneumonia
  - Appropriate antibiotic / antifungal therapy
  - Oxygen supplementation
- Feline asthma
  - Bronchodilator therapy
- Canine chronic obstructive pulmonary disease
  - Minimize stress
  - Oxygen therapy?
Critical Care Ventilation
- Deliver 21-100% FiO2
- Pressure- or Volume Controlled
- Allows for time for recovery if possible
  - Risk
  - Cost
  - Labor-intensive

Complications
Ventilator Therapy:
- Pneumothorax
- Pneumonia
- General anesthesia
- Manage all bodily functions

Disease:
- Failure to respond to treatment
  - No treatment/ cure available.
  - Co-morbidities/ Organ dysfunction/ Failure

Prognosis Depends on Cause
- Upper airway / neuromuscular disease: Px fair to guarded
- Acute lung disease, previously healthy: Px guarded
- Chronic pulmonary disease: Px poor to grave
Respiratory Management Summary:

- Response to oxygen?
  - Hypoventilation, diffusion impairment, low V/Q disorders (venous admixture)
- Response to anxiety relief?
  - Upper airway obstruction
- Response to analgesia?
  - Pain on chest excursions
- Respiratory failure?
  - Insure airway patency!
  - Ventilation is difficult long-term