MECHANICAL VENTILATION IN VETERINARY ANESTHESIA IN DOG AND CAT: A LITERATURE REVIEW

INTRODUCTION:

Mechanical ventilation (MV) is essential in veterinary anesthesia for dogs and cats, **assisting or replacing spontaneous breathing** to ensure adequate gas exchange during surgery. The main goal is to support breathing, especially when the animal's respiratory system is compromised.
By controlling ventilation parameters, veterinarians can **optimize respiratory function and reduce anesthesia-related risks.**

OBJECTIVES:

This poster reviews the principles, indications, and applications of MV in veterinary practice, including relevant **respiratory physiology, ventilator parameters and types**, and **potential side effects**. This knowledge is essential for veterinarians to make informed decisions during anesthesia and improve patient outcomes.

PHYSIOLOGY:

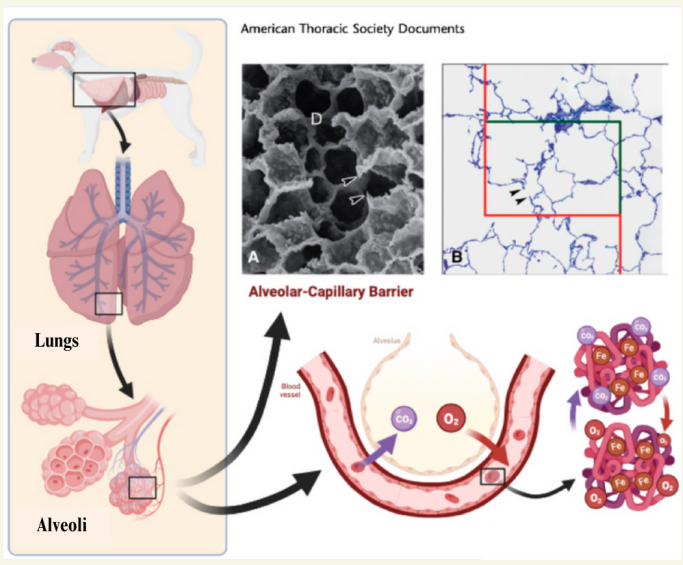

Fig. 1: Physiology of respiration
Alveoli picture from American Thoracic Society Documents

Importance in Mechanical Ventilation

Understanding respiratory physiology is **crucial:** The **delicate alveoli** and bronchioles, present significant complexities when managing MV. Each component must be **carefully considered** to **ensure continuous oxygen delivery** and carbon dioxide removal, stabilizing the animal's respiratory status during surgery while **respecting the patient's physiological structures** and **preventing damage**.

POSITIVE PRESSURE VENTILATION MODES:

Fig. 2: Mechanical Ventilator
Picture from UAB

Two modes: controlled and assisted ventilations.

- **Controlled ventilation:**

The operator sets all parameters, and the machine initiates breathing.

- **Assisted ventilation:**

The animal's breathing rate triggers inspiration. Rarely used in veterinary anesthesia.

INDICATIONS FOR MECHANICAL VENTILATION IN ANESTHESIA:

The most **common causes** can be classified into **two categories:**

Alteration of Central Control of Ventilation:

1. Respiratory depression under **drugs** (morphine, isoflurane, etc.)
2. Prolonged **hypothermia**
3. Severe **hypoxia**
4. **CNS** physical **alteration** (tumor, stroke, etc.)

Physical Inability:

1. Thoracic **surgery**
2. **Laparoscopy**
3. Body **positioning** (urinary tract surgeries, hernias, perineal)
4. **Obesity**
5. Muscular **paralysis** (myopathies, neuromuscular diseases)

TYPES OF VENTILATORS:

The respiratory cycle of an animal consists of **four distinct phases. Volume and pressure are correlate** with inspiration or expiration times. The operator must adjust **preset parameters** according to the volume, pressure, or time mode.

Volume-Cycled Ventilators:

Volume-cycled ventilators ensure a **preset tidal volume** at each breath. The Pressure increases progressively and the **Flow increases** until it reaches its maximum.

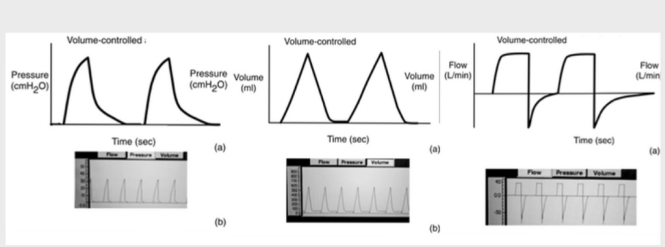

Fig. 3: Evolution of the parameters (P, V, F) in a volume-cycled mode
Journal of Veterinary Emergency and Critical Care

Pressure-Cycled Ventilators:

Pressure-cycled ventilators **limit peak inspiratory (PIP)**, it delivers air until a **preset pressure** is reached.
The Volume increases progressively with a **non-constant Flow** that increases and decreases during the inspiration.

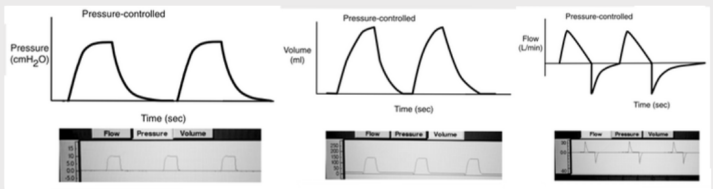

Fig. 4: Evolution of the parameters (P, V, F) in a volume-cycled mode
Journal of Veterinary Emergency and Critical Care

Time-Cycled Ventilators:

Time-cycled ventilators control the duration of inspiration, it delivers air for a **preset duration**. Same curves as Volume Cycling.

In each mode, we must choose a panel of other parameters

PARAMETERS:

	CAT/DOG	Lung diseases
VT (mL/kg)	6-15	6-8
Vm (mL/kg)	150-250	100
FR (/min)	10-20	15-20
I:E	1:2	1:2
PIP ($cm H_2O$)	5-7/8-15	30
PEEP ($cm H_2O$)	0-4	4-8
F (L/min)	40-60	40-60
T (s)	0.8-1	0.8-1

SIDE EFFECTS:

MV can lead to **several rare potential side effects**. Understanding this, is crucial for ensuring **patient safety** during anesthesia. These include:

- **Baro/Volutrauma:**

Caused by **over-distension and high pressure** , leading to lung injury.

- **Hypotension:**

High ventilation pressures cause it by reducing cardiac output and altering arterial pressure.

- **Atelectasis:**

Or the collapse of alveoli, may arise from **insufficient pressure**.

- **Hypoventilation:**

Can occur if the **tidal volume is too low**, resulting in hypoxemia and hypercapnia.

- **Auto-PEEP:**

Air trapping due to **inadequate expiratory time.**

- **Inflammation:**

Improper ventilation settings can lead to it due to an **imbalance in the I:E.**

CONCLUSION:

MV is an indispensable tool in the management of veterinary anesthesia. It ensures the maintenance of **adequate ventilation and oxygenation**, which are critical for the successful outcome of surgical procedures. This involves not only choosing the correct **ventilator settings** but also **continuously monitoring** the patient's response to ventilation and making necessary adjustments.

The application of MV significantly enhances patient care, **allowing for more complex and lengthy procedures** to be performed **safely**. As the field of veterinary medicine advances, continuous education and **research** into MV techniques **will be essential** in further improving the outcomes for our animal patients.

FINAL DEGREE PROJECT

CONVOCATION DAY:
TUESDAY, JUNE 18, 2024, 9 AM - 1 PM
EVALUATION COMMITTEE 4

UAB Universitat Autònoma de Barcelona

UAB FACULTY OF VETERINARY MEDICINE

FACULTAT DE VETERINÀRIA

Lorane Émeline ROCHE

Class of 2019-2024