

The Mechanics of Ventilation

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The Mechanics of Ventilation

Objectives:

To explain the following:

- Pressure cycled ventilation
- Compliance & its implications to IPPV
- The changes in dynamics that occur with IPPV
- The implications of measuring pressure at the mouth rather than the lungs
- How to connect a pressure-cycled device to a patient and get going

Vetronic Services Small Animal Ventilator



Why Mechanical Ventilation?

- Better than manual efforts because it is very difficult to be.....

A) Sure of the ventilating pressure

B) Consistent.

Why Mechanical Ventilation?

- There are a number of major beneficial effects of Mechanical ventilation:
 - 1) It ensures oxygen delivery to the patient
 - 2) It ensures anaesthetic agent delivery to the patient.
 - 3) It aids in the removal of waste products – CO₂

What Is Pressure Cycling?

- For any ventilator there must be a way to change from one phase to another.
- Commonly..

Pressure cycling

Volume cycling

Time cycling

What Pressure Setting Do I Use?

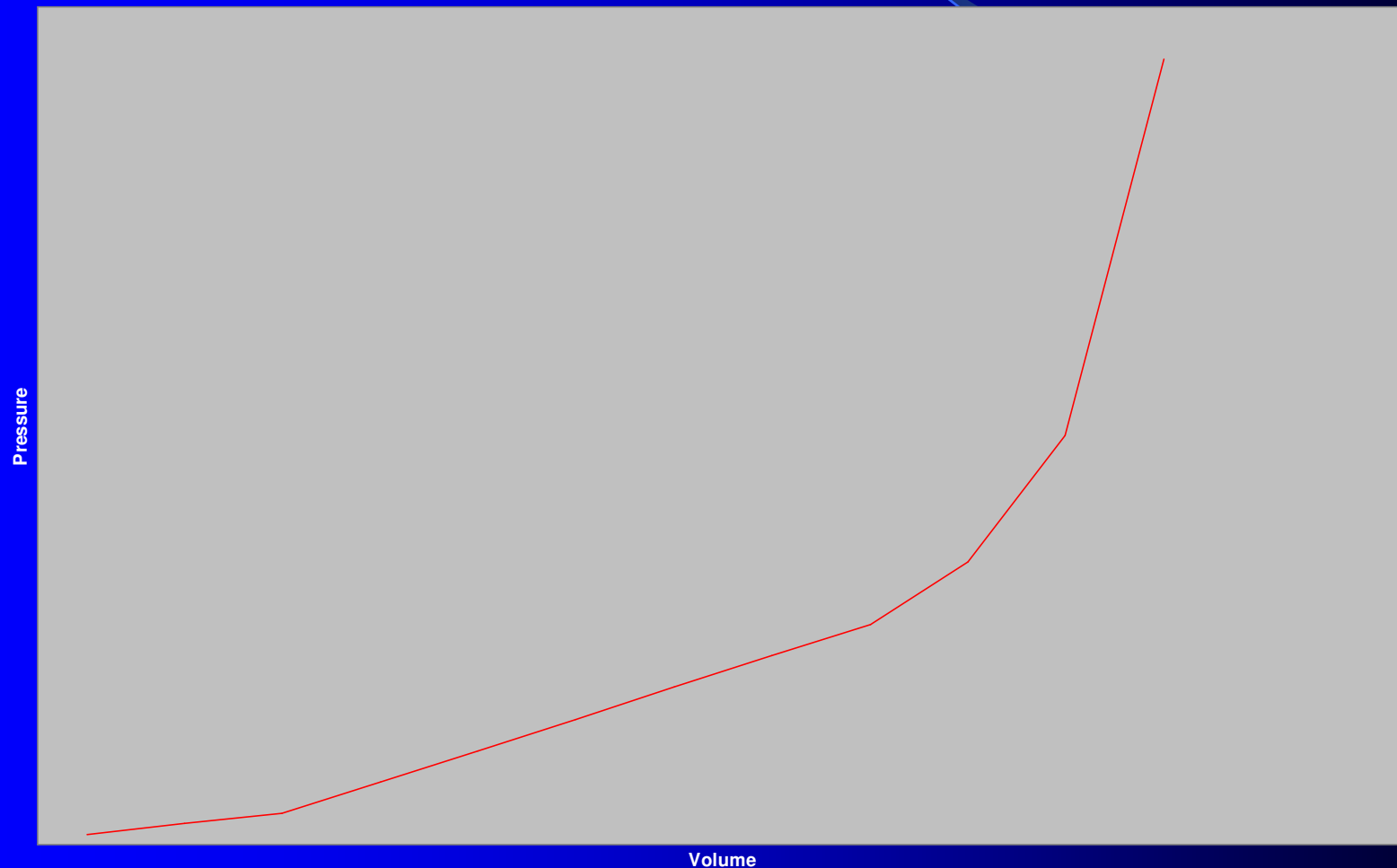
- Typically anything can be ventilated between 3 and 20 cm H₂O.
- Most lie within 5 to 12 cm H₂O pressure.

Start at a low setting of 3 cm H₂O and increase slowly.

Adjust the pressure for normal respiratory movements.

Note that due to the finite compliance of the chest it is intrinsically much safer to adjust pressure than it is volume.

Pressure Versus Volume Plot



What Is Compliance?

- Compliance = volume change/pressure change. Units are mls/cm H₂O.
- It is a measure of the elasticity of the respiratory system. The higher the value the more elastic is the system.

Why Understand Compliance?

- Compliance = V/P . So $V = C \times P$.
- Any change in compliance will affect the volume of gas delivered to the lungs. You may need to adjust the pressure settings to accommodate changes in compliance during surgery.

Do I Need To maintain the animals normal breathing rate?

Yes, and.....

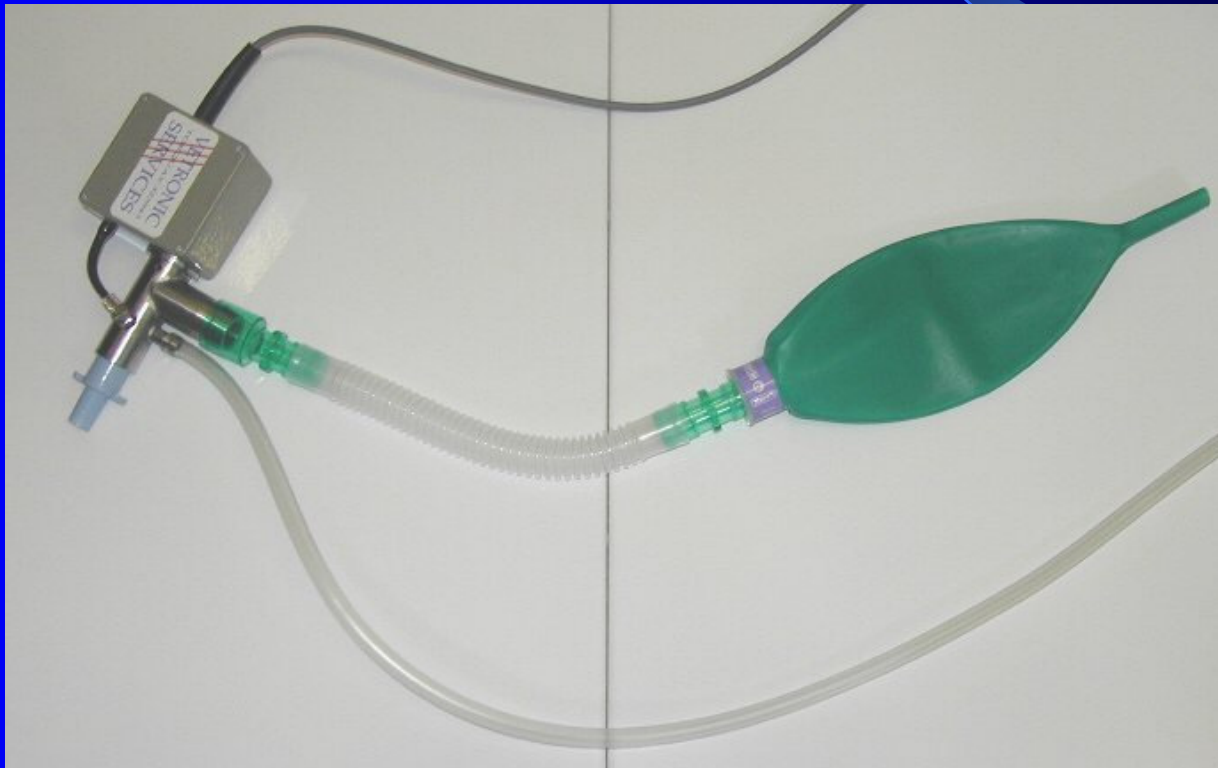
Possibly, NO !

The smaller the animal the greater the energy expended in breathing.

E.g. a rat expends 4 times as much energy breathing as a dog.

The importance of maintaining body temperature increases because otherwise energy is expended in metabolism and the benefits of reduced workload are lost.

Anaesthetic Circuit Configuration



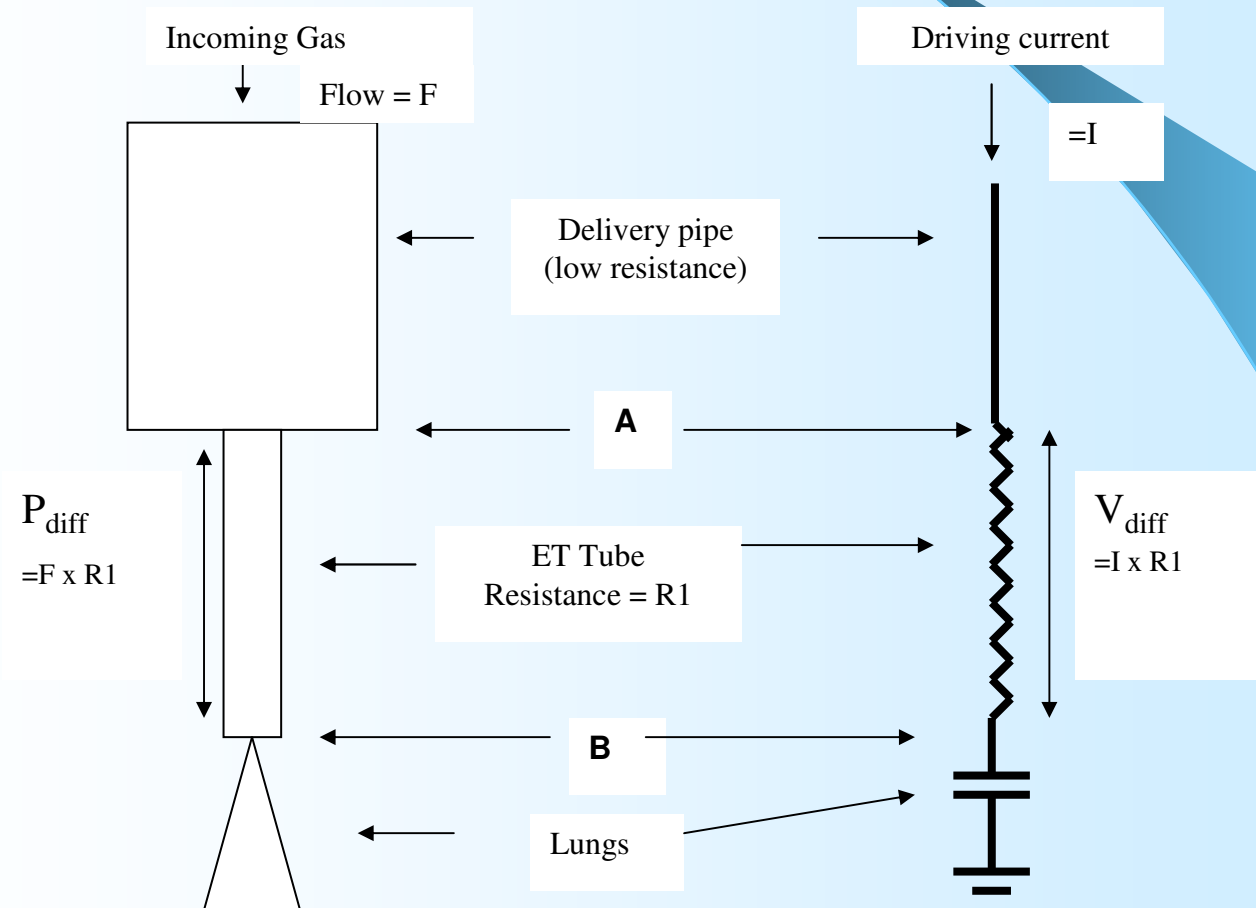
Anaesthetic Circuit Configuration



Anaesthetic Circuit Configuration

- During IPPV the expiratory circuit plays no part in the respiratory cycle.

The Paradox of Reduced Tidal Volume When Increasing Flow Rate



Summary

- Mechanical ventilation offers benefits of controlled gas delivery and consistency.

Pressure cycled ventilation is inherently safer

Pressure settings do not need to be learned. The ventilator is “tuned” to the patient.

Understanding Compliance helps in understanding the need to adjust settings during surgery

Respiratory rates can be reduced for animals with a high respiratory rate and relatively small body mass.

The implication of a small ET tube must be understood to avoid under-inflation.