ALFAXALONE FACTS

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Characteristics

- Neurosteroid in Cyclodextrin
- One of the steroid anesthetics found in Saffan®
- Acts on the $GABA_A$ receptor
  - Unconsciousness and muscle relaxation

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Cardiovascular Effects

- Similar cardiovascular effects to propofol
  - ↑HR
  - ↑ or ↓C.O. (dose dependent)
  - ↓ BP (vasodilation)

Veterinary Anaesthesia and Analgesia, 2008, 35, 451-462
Cardiorespiratory and anesthetic effects of clinical and supraclinical doses of alfaxalone in dogs
W Muir, P Lerche, A Wiese, L Nelson, K Pasloske, T Whittem

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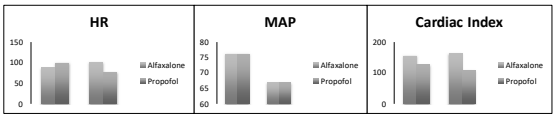
Cardiovascular Variables



***J Am Vet Med Assoc.* 2019;254(12):1421-1426**
Recovery characteristics of dogs following anesthesia induced with tiletamine-zolazepam, alfaxalone, ketamine-diazepam, or propofol and maintained with isoflurane.
Hampton CE, Riebold TW, Mandsager RE.

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Cardiovascular effects during CRI

- Dose dependent cardiovascular and respiratory depression
- Similar to propofol

AJVR, 2008, 69(11): 1391-8
Comparison of the anesthetic efficacy and cardiopulmonary effects of continuous rate infusions of alfaxalone-2-hydroxypropyl-beta-cyclodextrin and propofol in dogs
Ambros B, Duke-Novakosvski T, Pasloske KS

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Respiratory Effects

- Dose dependent:
  - Respiratory depression
    - Hypercapnea is common
  - Decrease in PaO2
    - hypoxemia can occur, oxygen supplementation is advisable
  - Apnea –MOST COMMON SIDE EFFECT!!!
    - » Always have endotracheal tubes with you and a anesthetic machine ready

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APNEA

- Most common side effect independent of route of administration

Alfaxalone is not a sedative and should not be used as one!!

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Neurologic Effects

- CNS friendly
- Excitation in cats during recovery (IM route)
- Longer duration compared to propofol

Br J Anaesth. 1985 Apr;57(4):369-74.
Use of a continuous infusion of althesin in neuroanaesthesia. Changes in cerebral blood flow, cerebral metabolism, the EEG and plasma alphaxalone concentration.
Bendtsen A, Kruse A, Madsen JB, Astrup J, Rosenørn J, Blatt-Lyon B, Cold GE.

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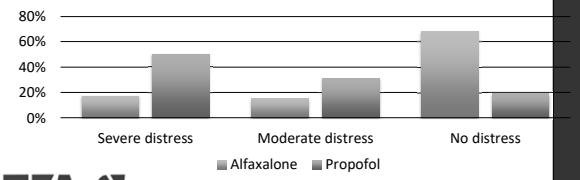
APGAR SCORES

Percentage of puppies in each score category within 5 minutes of birth



***Theriogenology*, 80 (2013): 850-854**
Apgar score after induction of anesthesia for canine cesarean section with alfaxalone versus propofol
A. Doebelia, E. Michela, R. Bettschartb, S. Hartnackc, I.M. Reichlera

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Theriogenology

- Allopregnanolone analog
- Potential protective effect in premature fetus when labor is induced by glucocorticoids (Betamethasone)

Neuropharmacology. 2014 Oct;85:342-8.
The effects of betamethasone on allopregnanolone concentrations and brain development in preterm fetal sheep.
Yawno T, Mortale M, Sutherland AE, et al.

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Quality of Anesthesia Recovery

- Smooth recovery for propofol and alfaxalone
- Poorer with Ketamine/diazepam and Telazol

Note: Alfaxalone half-life is longer than propofol

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Doses

- Dose
  - Cat: 2-5 mg/kg IV
    3-5 mg/kg IM
  - Dog: 1-3 mg/kg IV
    1-3 mg/kg IM (limited by volume in large dogs)

Vet Anaesth Analg. 2017 Jul;44(4):794-802
Intramuscular injection of alfaxalone in combination with butorphanol for sedation in cats.
Deutsch J, Jolliffe C, Archer E, Leece EA.

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Cardiorespiratory	Neurologic
• Similar cardiovascular effects to propofol – ↑HR – ↑ or ↓C.O. (dose dependent) – ↓ BP (vasodilation) • Dose dependent respiratory depression – Apnea after bolus	• CNS friendly • Potential protective effect in premature fetus when labor is induced by glucocorticoids (Betamethasone) • Excitation in cats during recovery (IM route) • Longer duration compared to propofol

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- No difference between the cardiovascular and respiratory effects of propofol and alfaxalone
- NO support alfaxalone safer than propofol
- Same safety precautions:
  - Endotracheal tubes, oxygenation, anesthesia machine available and MONITORING!!

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Opinion

- Can be use interchangeably with propofol
- Main advantage: CAN BE GIVEN IM
  - Great substitute for Ketamine (in cats)
- Careful with apnea and overdose during induction (dose dependent hypotension)

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CAPNOMETRY: CLINICAL INTERPRETATION OF VALUES AND WAVEFORMS

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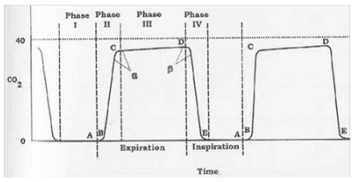
DEFINITION OF CAPNOGRAPHY

- Graphic representation of respiratory CO_2
- EtCO2 is the expired pressure of carbon dioxide
- $EtCO_2$ is an approximation of $PaCO_2$



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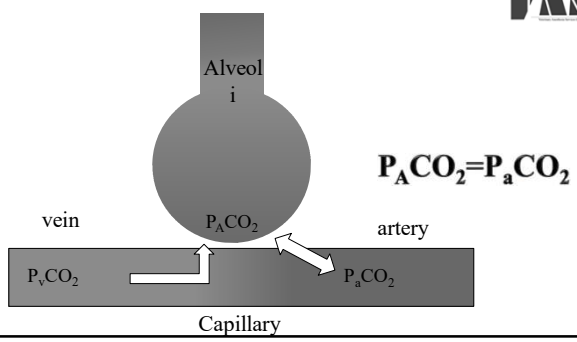

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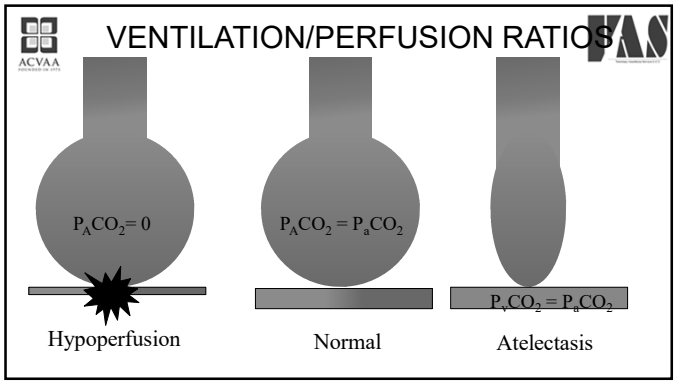
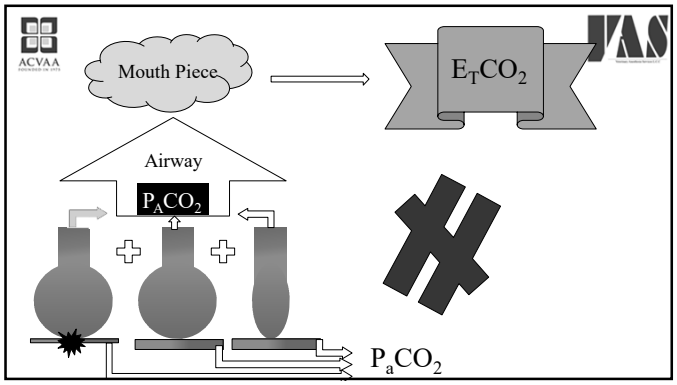

VENTILATION/PERFUSION RATIOS
$P_ACO_2 = 0$
$P_ACO_2 = P_aCO_2$
$P_vCO_2 = P_aCO_2$
Hypoperfusion
Normal
Atelectasis

4


Mouth Piece
E_TCO_2
Airway
P_ACO_2
P_aCO_2

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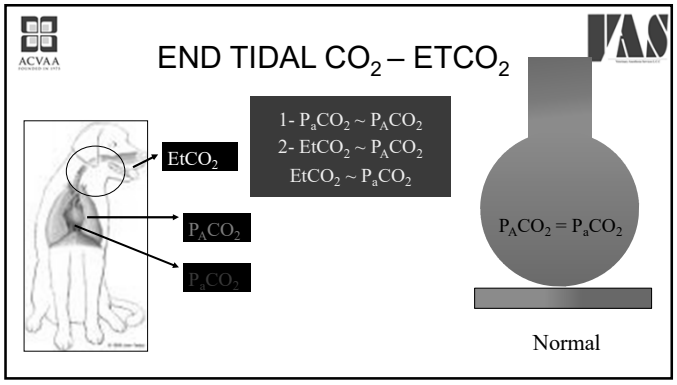
END TIDAL CO_2 – $ETCO_2$
1- $P_aCO_2 \sim P_ACO_2$
2- $EtCO_2 \sim P_ACO_2$
$EtCO_2 \sim P_aCO_2$
$EtCO_2$
P_ACO_2
P_aCO_2
$P_ACO_2 = P_aCO_2$
Normal

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LEARNING ASSESSMENT!!

- Healthy 2 year old Lab recovering from a TPLO. After oxygen is removed SpO2 is low (88%). Differentials? Most likely? Diagnostic planning…

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DIFFERENTIALS FOR HYPOXEMIA

- HYPOVENTILATION (>45 mmHg P_aCO_2)
- V/Q mismatch (atelectasis)
- Alveolar diffusion barrier
- R-L Shunt (vascular anomaly)
- Low inspired oxygen concentration (below 21% of O_2)

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DIAGNOSTIC PLANNING

HYPOVENTILATION

- Check PaCO2 for abnormality
  - Can use ETCO2
  - Can use Blood Gas (BETTER $$$)
    - Why not try first the ETCO2?
      - Specially if still intubated
      - Can still do even if not intubated

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POSSIBILITIES OF ETCO2 VALUES

Lower than normal (Hyperventilation)	Normal (Euventilation)	Higher than normal (Hypoventilation)

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POSSIBILITIES OF ETCO2 VALUES

Lower than normal EtCO2 But way higher PaO2	Normal EtCO2 But way higher PaO2	Higher than normal But higher PaO2

Misleading EtCO2 values

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WHAT TO LOOK FOR:

DURING ANESTHESIA (100% O2)

- Animal panting with normal temperature
- Tachycardia and Tachypnea
- Seems light but at expected or higher concentration of inhalant
- Hypertensive
- Non opioid responsive

DURING RECOVERY (21% O2)

- PulseOxi at low 90s or below 90%
- Animal seems still very sedated
- Potential over use of opioid (CRI) or recent dose of one
- Obese animal

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FACTORS AFFECTING ETCO2

PROCEDURES
- THORACOTOMIES
- LAPAROSCOPIES
- TRENDELEMBURG POSITION
- SOME ORTHOPEDIC JIGS

PATHOLOGIES
- GDV
- RESPIRATORY Dz
- OBESITY
- CARDIOVASCULAR Dz

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APPLICATIONS FOR ETCO2 MONITORING

- CO2 analysis can assess (E_tCO_2 vs P_aCO_2)
  - Ventilation
  - Metabolism
  - Cardiovascular status
  - Equipment/ patient problems

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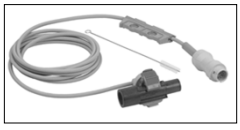
CAPNOMETRY

Equipment Design
- Mainstream
- Side stream



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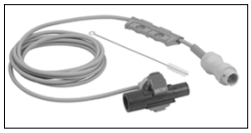
MAINSTREAM

- Infrared
- Light Absorption
- Dissimilar atoms
- Cannot measure O_2



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MAINSTREAM

Advantages	Disadvantages
• Less maintenance	• Fragile sensor
• Less disposable parts	• Adds weight on tube
• No scavenging	• Adds dead space
• Fast response time	• Longer warm up time
• No standard gas	• Measure CO2 only

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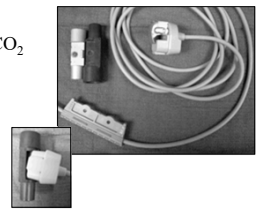
MAINSTREAM

False low Et CO_2

Correct



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SIDESTREAM

- Infrared,
- Mass Spectrometry
- Raman Spectrometry

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SIDESTREAM

Advantages
- Possible multi gas analysis
- Away from patient
- Inexpensive and light interface

Disadvantages
- More disposable parts
- Longer response time
- Calibration cylinder
- Scavenging required
- Water Trap

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CAPNOMETRY BENEFITS

- Proper Intubation
- Malfunction
- System Integrity
- Respiration/Circulation
- Rebreathing
- Respiratory depression
- Change in Metabolic Rate
- Best tool during CPR

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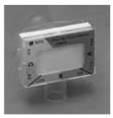
CHEMICAL COLORIMETRIC ANALYSIS

- pH sensitive chemical indicator
- Changes color with change in pH
- Not quantitative!!
- Careful with contamination
- Easy Cap II

- Useful to check:
- Intubation
- Apnea
- Careful with low CO_2 (< 0.5%)



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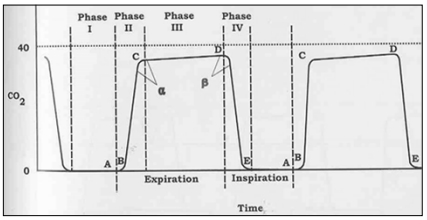
NORMAL CAPNOGRAPH



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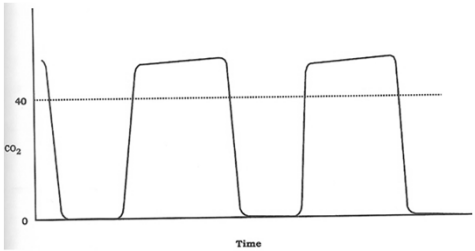
HYPERCAPNEA



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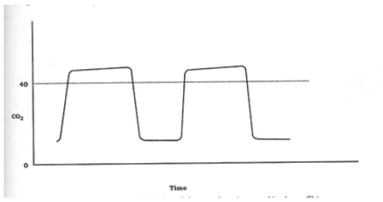
REBREATHING



CAREFUL WITH SIDESTREAM! TRULY REBREATHING?

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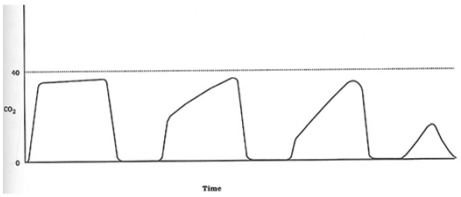
AIRWAY OBSTRUCTION



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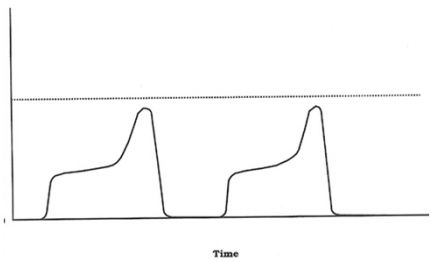
SAMPLING LINE LEAK AND IPPV



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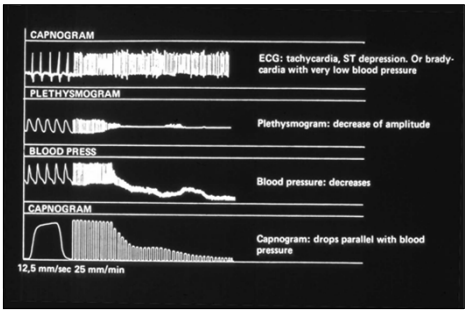
BLOOD LOSS



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CAPNOMETRY

- Factors affecting accurate $ETCO_2$ measurement
  - Ventilation/Perfusion status
    - Open thorax
  - Integrity and type of machine
  - Contamination
  - Equipment error

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CONCLUSION

Great tool

- Proper intubation
- Apnea
- Cardiorespiratory and metabolic status
- Equipment integrity

Careful use

- May underestimate $PaCO_2$
- May require blood gas for true ventilatory assessment ($PaCO_2$)

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