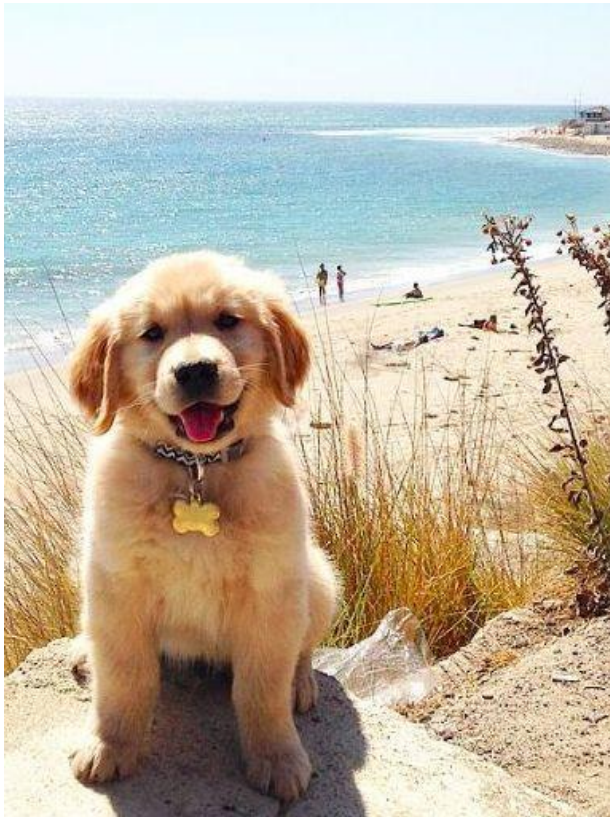


What's Your Capno IQ?

The Fundamentals of Capnography for Veterinary Nurses

If you were on an island stranded with 1 form of monitoring equipment besides yourself, which would you choose? Why?



- Pulse Oximetry?
- Blood Pressure?
- Electrocardiogram?
- Temperature?

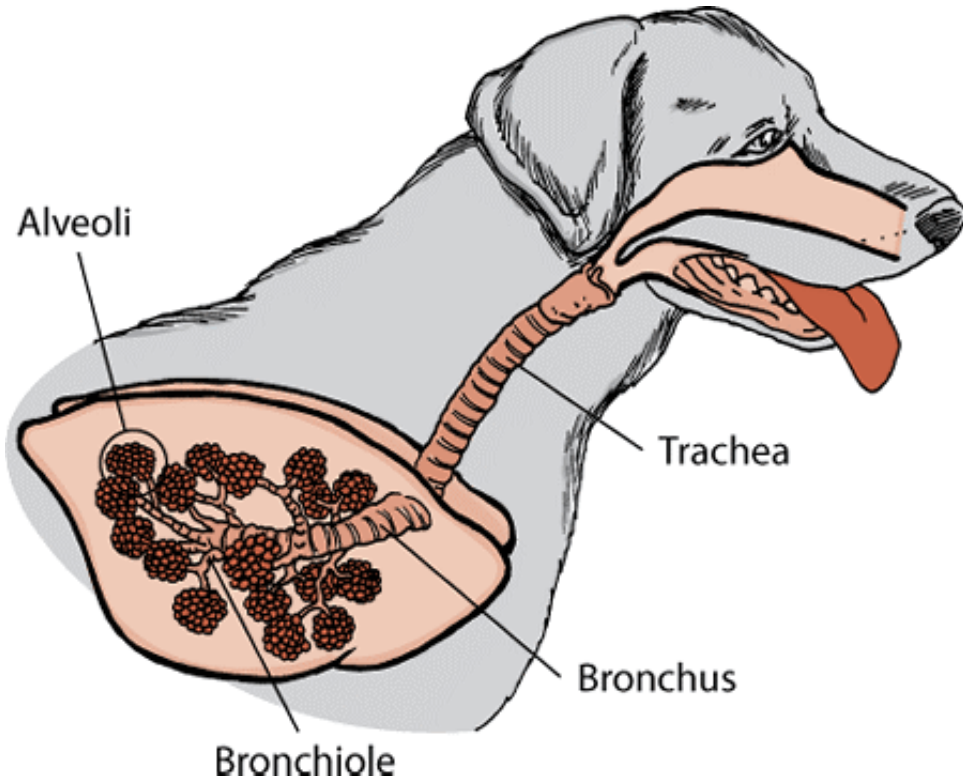
Capnography is awesome! And here is why:



It tells us about the quality of:

- Ventilation
- Cardiac Output
- Metabolism
- Intubation
- Chest Compressions

The Big Respiratory Picture



Cellular Metabolism

Of food is turned into energy, O_2 Inhaled, and CO_2 Exhaled

Transport

Of O_2 and CO_2 between cells and pulmonary capillaries, and diffusion from/into alveoli.

Ventilation

Between alveoli and atmosphere

How does CO₂ work?

- The body metabolizes oxygen inhaled, along with water, glucose and nutrients to produce energy.
- The red blood cells carry that energy to the organs.
- The byproduct of that energy is CO₂ which is return to the lungs to exhale.
- The respiratory center of the brain monitors how much CO₂ is in the blood and either increases or decreases the respiratory rate to adjust CO₂ levels.



Capnography, Capnometer, Capnogram

- **Capnography** is the measurement of carbon dioxide in exhaled breath (ventilation) EtCO₂ measures the level of CO₂ at the END of exhalation.
- A **Capnometer/Capnograph** is a mainstream or sidestream device that numerically displays the concentration of CO₂ in exhaled air.
- A **Capnogram** is the waveform we see in the monitoring device that shows us trends in inhalation and exhalation.

How does it read CO₂ ?

- CO₂ molecules absorb infrared light energy of specific wavelengths, with the amount of energy absorbed being directly related to the CO₂ concentration.
- When an IR light beam is passed through a gas sample containing CO₂, the electronic signal can be obtained. This signal is then compared to the energy of the IR source, and calibrated to accurately reflect CO₂ concentration in the sample.

Mainstream Capnometers



- Sits directly next to the patient
- Measures CO₂ that passes directly through the airway to the patient
- Fast-Response, Perfect for CPR
- Size of patient doesn't matter because no gas is withdrawn or diluted
- Only for intubated patients
- Bulky, Heavy Monitor, Battery Operated
- Expensive

Sidestream Capnometers



- Portion of breath is sucked down tiny tube for analysis inside of main unit
- Time-lapse: about 2-3 breaths behind
- Underestimates for smaller patients
- Works for nasal tubes and intubated patients
- Lightweight, attached to machine
- Can be used with MRI
- Lines can become clogged with condensation
- Can have more maintenance required

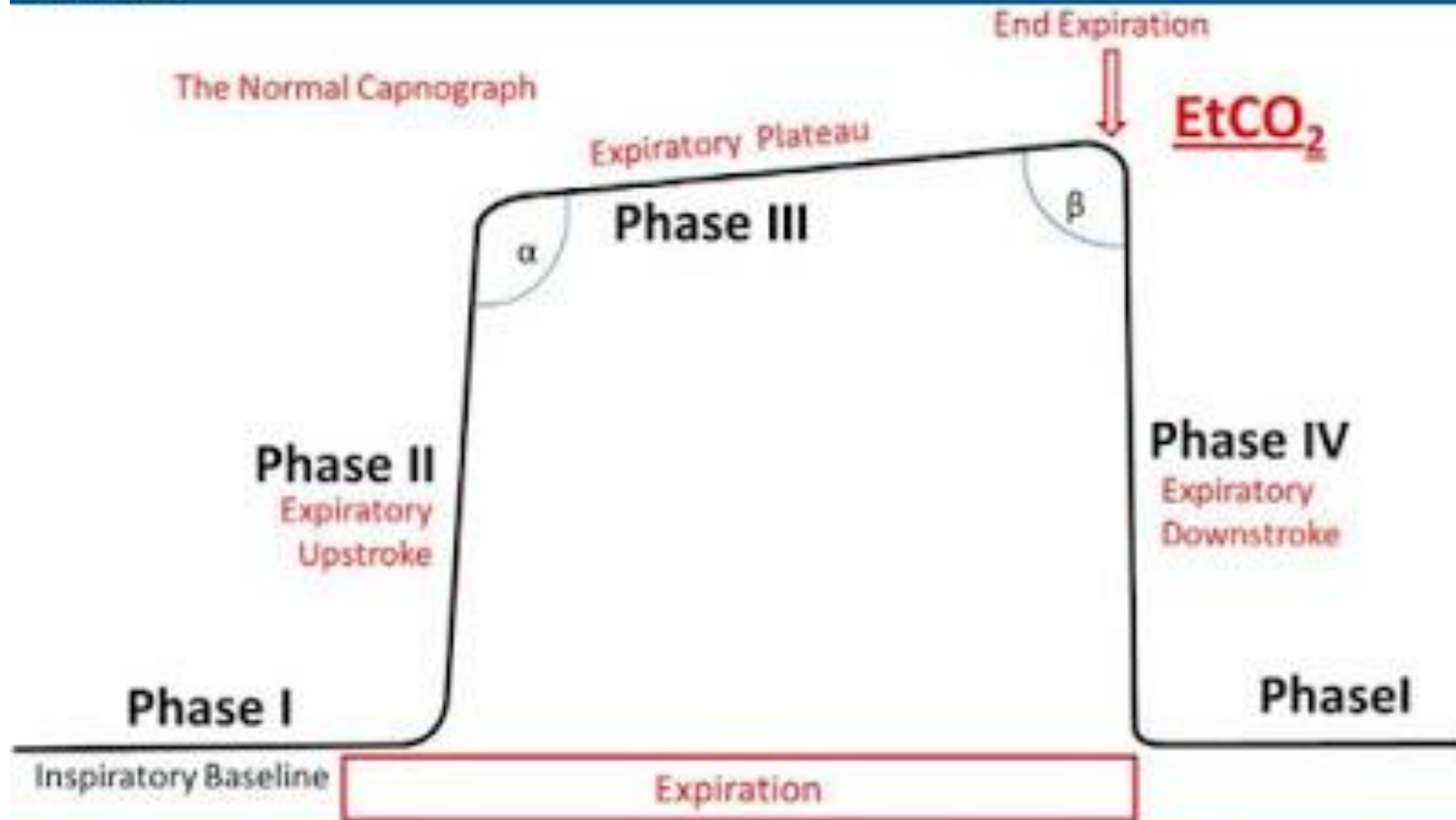
Ventilation VS Respiration



- Ventilation is air moving in and out
 - Physical Movement
 - Inhalation
 - Exhalation
- Respiration is the exchange of gases
 - Chemical Reaction
 - O₂ into the bloodstream
 - CO₂ leaving RBCs into lungs

Capnogram Waveforms Phases

Medscape



Source: J1 Emerg Med © 2013 Elsevier, Inc

Normal EtCO₂ VS Abnormal EtCO₂

NORMAL

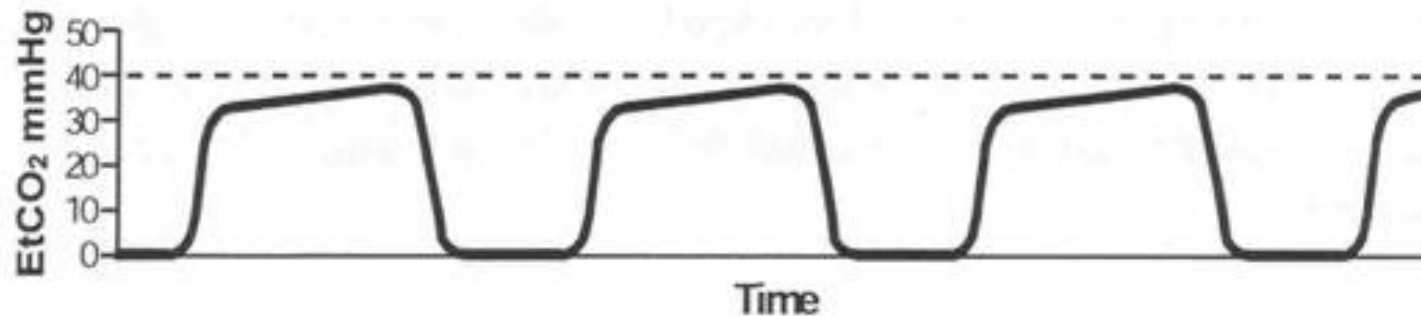
35-45 mmHg

HYPERCAPNIA

>45 mmHg
>60 Dangerous

HYPOCAPNIA

<35 mmHg
<15 Dangerous



Hypercapnia >45 mmHg

- Reasons: Hypoventilation, Too Deep, Obstructed Tube, Surgeon Leaning, Drugs, Pneumonia, RR set too low on ventilator, Soda Lime depleted, excessive dead space, Shivering
- What to do: ↑ RR until EtCO₂ is WNL, ↓ Anesthesia, Check for Kinks in tube, or Reintubate

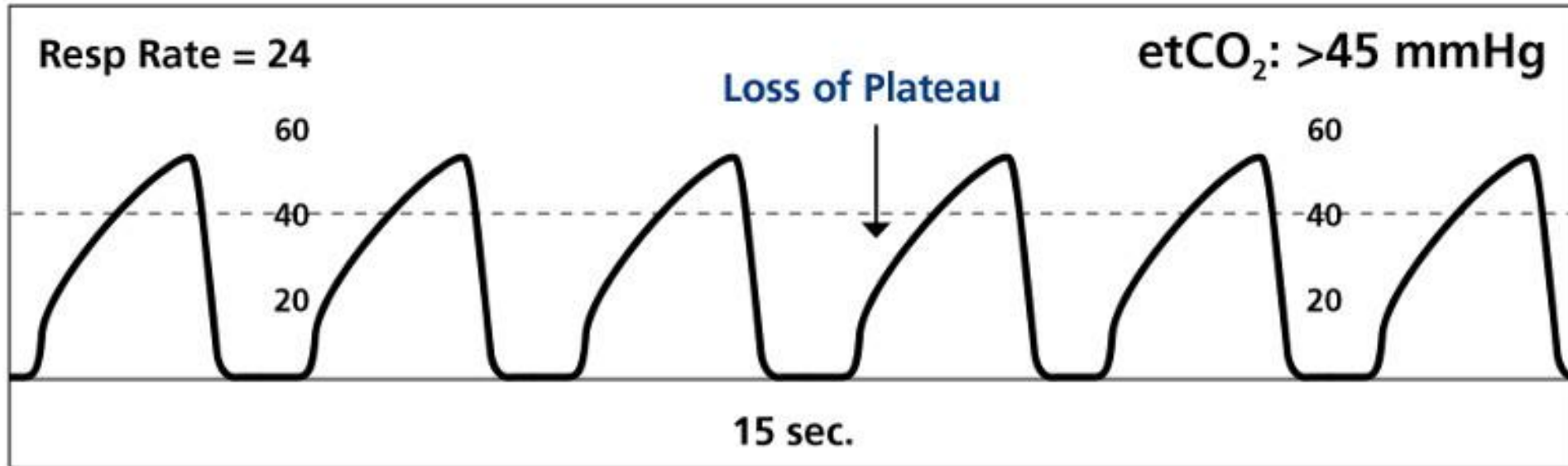
BEWARE OF OVER 60 EtCO₂ ! This in itself can become anesthetic and will deepen your patient further than they already are.

Hypocapnia <35 mmHg

- Reasons: Hyperventilation, Pain response, Too Light, ↓ Cardiac Output (Tachycardia), Over zealous assisted ventilation, Disconnected ET Tube, RR Set to Fast on Ventilator
- What to do: ↓ RR until EtCO₂ is WNL, ↑ Anesthesia, Pain Management, Lower Heat Support
- Consider having a pain management CRI during your procedure such as Hydro, Fentanyl or Morphine. This allows us to keep the patient on less inhalant anesthesia, and control their pain.
- Ketamine is also helpful to avoid bronchospasms because it is a bronchodilator.

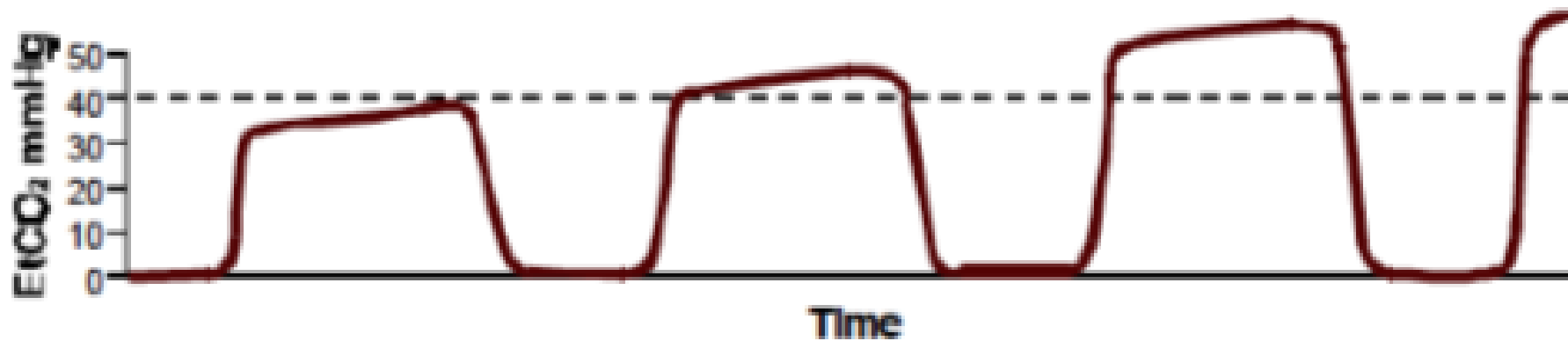
Capnograms: Shark Fins

Kinked ETT, ETT Plug, Bronchospasm, Obstruction



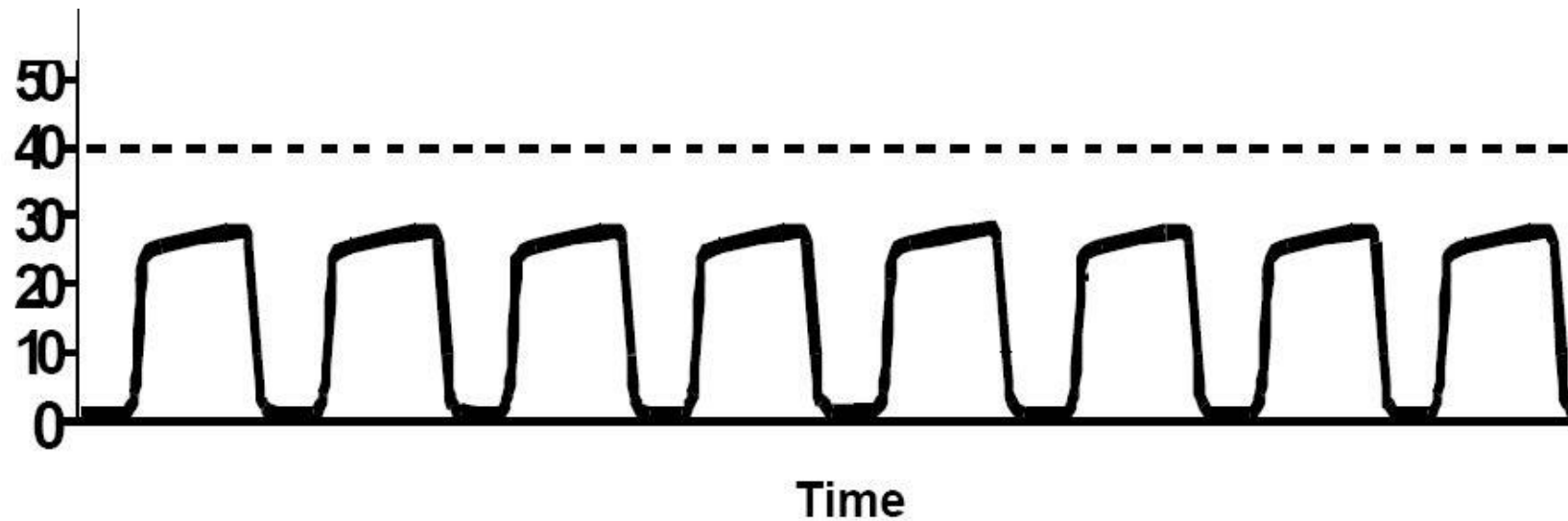
Capnograms: Hypoventilation

↓ RR, Deep Anesthesia, Dead Space, Early Stage of Pneumothorax



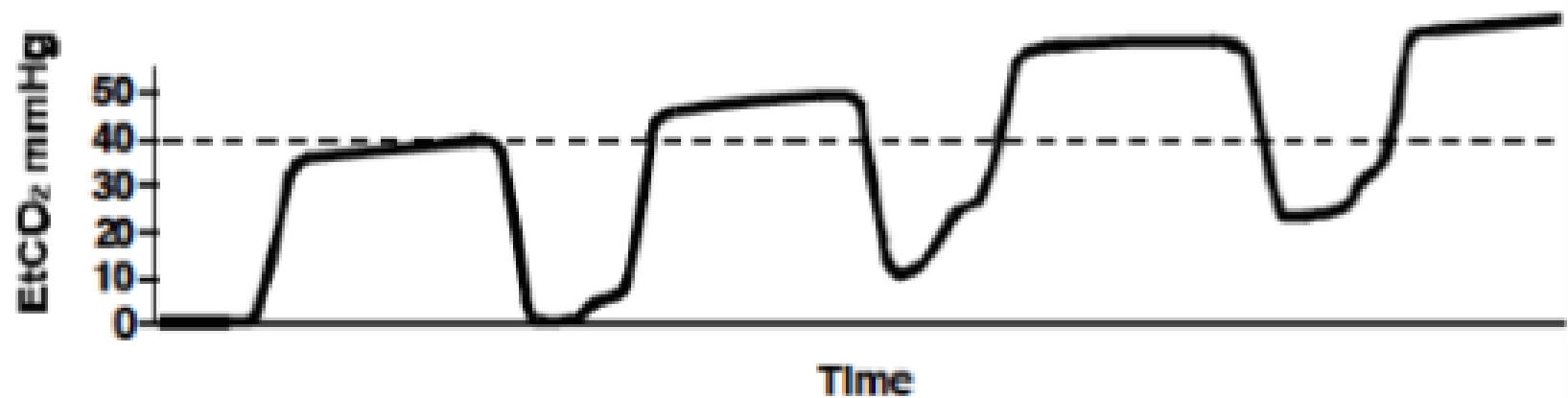
Capnograms: Hyperventilation

↑ RR, painful, too light with anesthesia



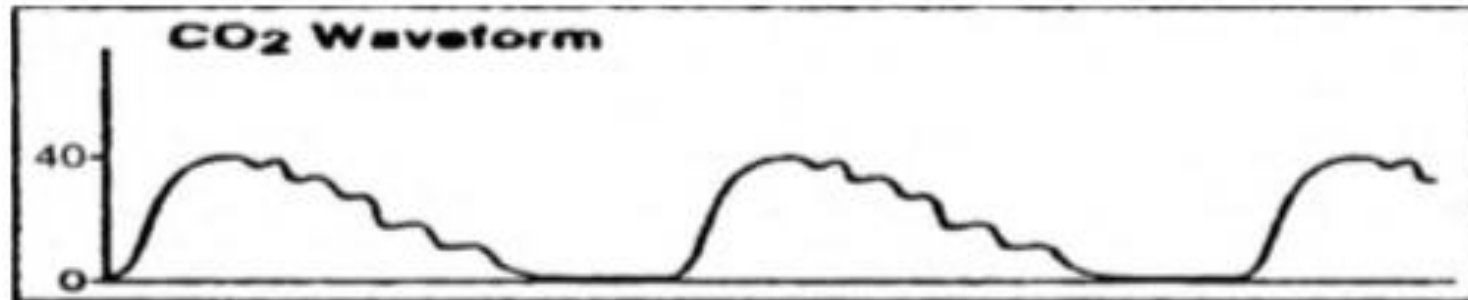
Capnograms: Baseline Does Not Return to 0

Oxygen Flow is too low, depleted soda lime, dead space, rebreathing CO₂, breathing too fast



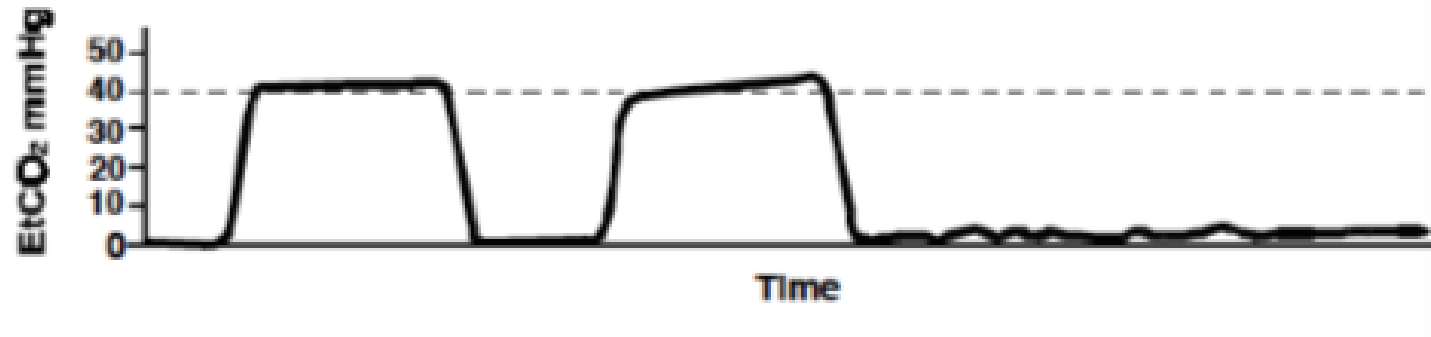
Capnograms: Abnormal Downstroke

ETT Leak, Not Inflated Correctly, Cardiac Impulses transmitted, sometimes heart causes it to flutter



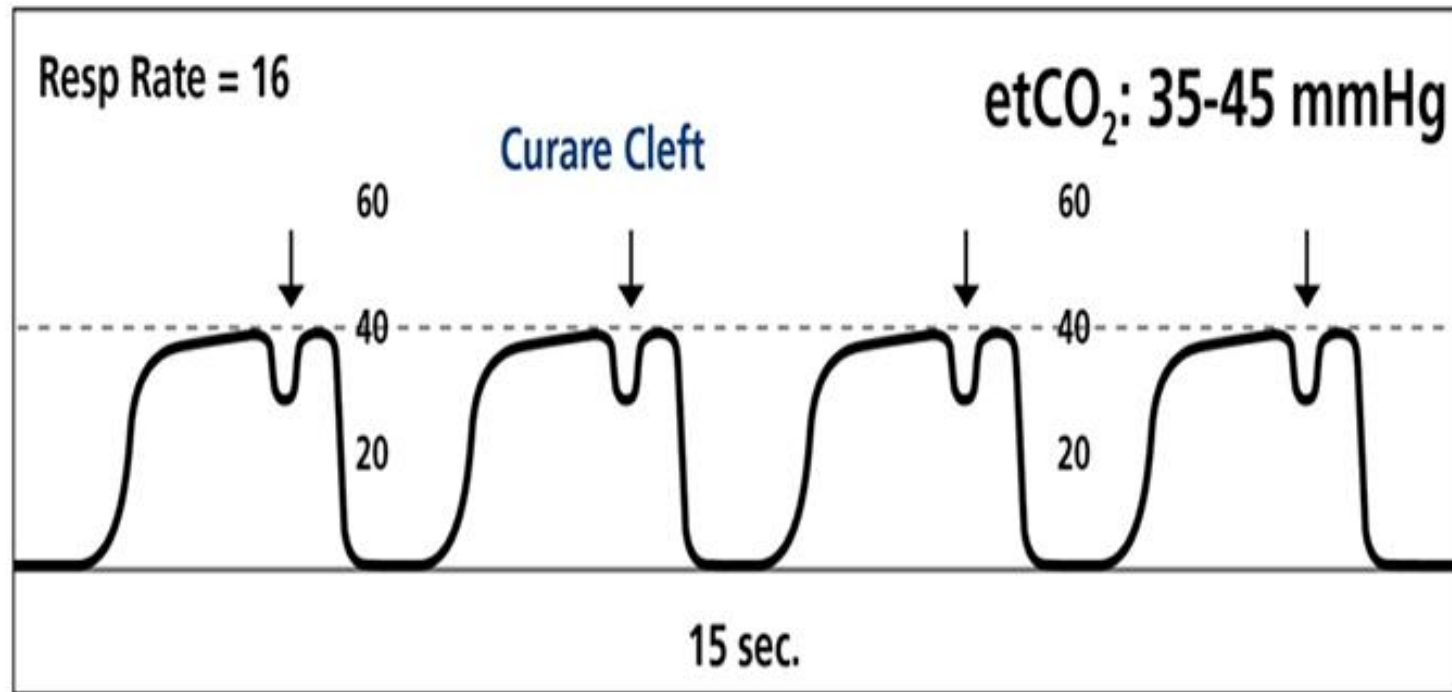
Capnograms: 0 CO₂ Value Recorded

ETT disconnected, esophageal intubation, obstruction, apnea, cardiac arrest, pop off valve left closed causing tension pneumothorax



Capnograms: Curare Cleft

When neuromuscular blockage wears off, spontaneous breaths,
Bucking the ventilator or assisted ventilation



EtCO₂ and CPR

- Loss of EtCO₂ may be the first indicator that CPR is needed
- Capnometer measures how the body responds to chest compressions regarding depth, rate and fatigue
- 15 - 25 mmHg during compressions means there is perfusion
- 50-65 mmHg means patient may be breathing on their own
- Confirms tube placement and prevents excessive hyperventilation
- Tells you when to stop, after 15-20 minutes of continuous readings <10 mmHg it is acceptable to discontinue CPR.

Treat the Patient, Not the Machine

- Normal Breathing?
- Rebreathing bag?
- Tube Disconnected?
- Soda lime Exhausted?
- Tube Placed Correctly?
- Correct Positioning?
- Airway Obstructions?
- Proper Cuff Inflation?
- Excessive Deadspace?
- Anesthesia Too High?
- Temperature Regulated?
- Pain Controlled?

Questions?

For copy of Powerpoint Email Me!
sgarcia@aavec.com

