CLINICAL CAPNOGRAPHY

END-TIDAL CARBON DIOXIDE MEASUREMENT ($ETCO_2$)

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Clinical Capnography

End-Tidal Carbon Dioxide Measurement ($EtCO_2$)

Why is this a need to know topic?

Technology for assessing the ventilatory (CO_2 elimination) aspect of respiration has reached a point that it now surpasses pulse oximetry in monitoring respiratory rate and depth of breathing; therefore the combination of capnography and pulse oximetry are recommended standards of care

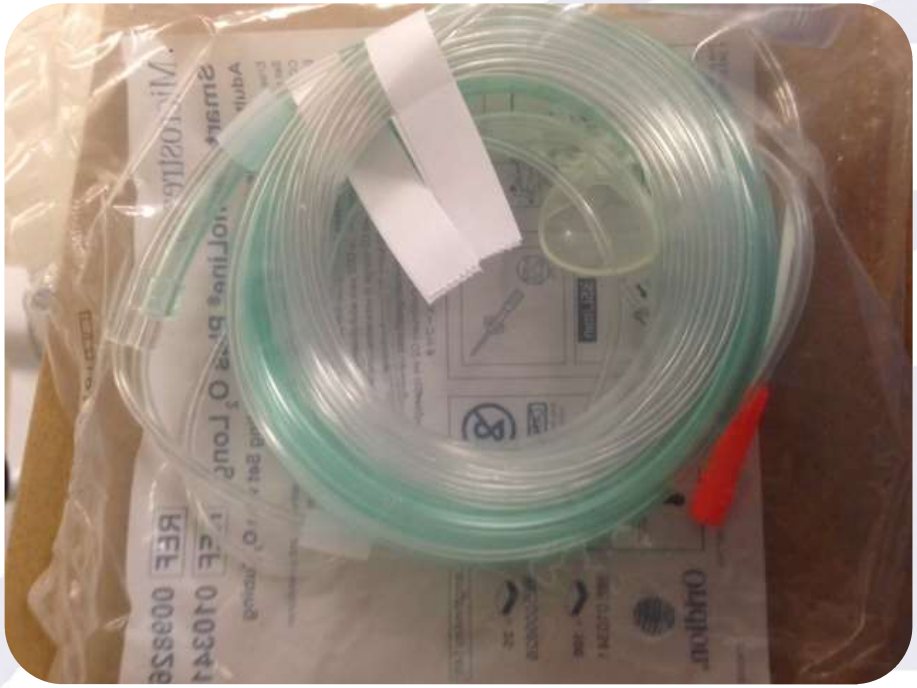
Clinical Capnography

(Measurement of $EtCO_2$)

Where will we be using this ?

- Standard of care for procedural sedation
- New standard of care for patients with sedation IV pumps
- Useful to assess ventilation without an arterial puncture
- Standard of care for CPR intubation and cardiac compression assessment

Nasal Oxygen Cannula with CO_2 sampling line



CO_2 Sample Line for Vents and NIVs

CLINICAL CAPNOGRAPHY

Since the exhaled CO_2 is coming out of the blood via pressure gradient the P_ECO_2 will always be less than P_aCO_2 or P_vCO_2 at any given time.

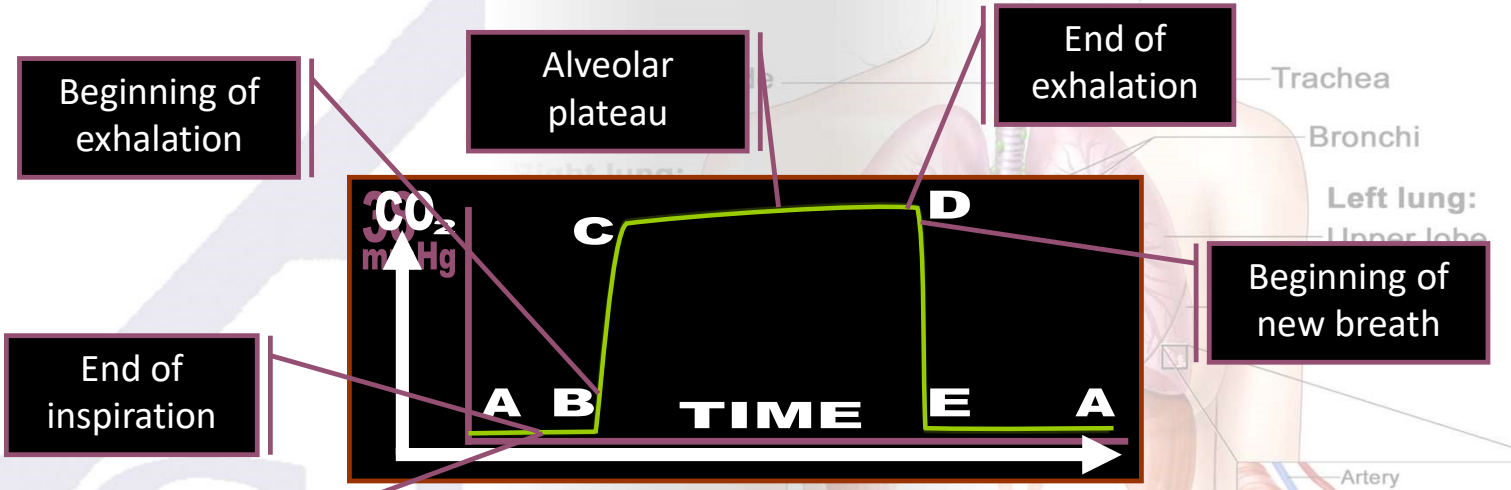
Normal values:

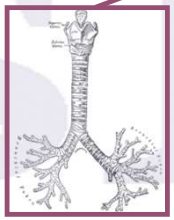
P_ECO_2 = 1 – 5 mmHg. < P_aCO_2

P_ECO_2 = 35 – 43 mmHg.

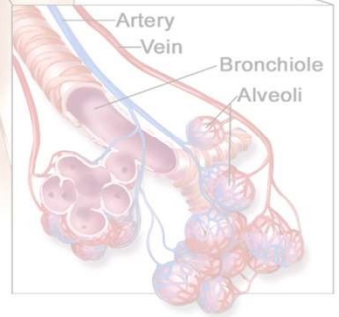
Capnography

Normal Waveform





Clearing of anatomic dead space



THE STANDARD OF CARE

Physiologic factors affecting $EtCO_2$ levels:

Increase in $EtCO_2$

- Increased muscular activity (shivering)
- Malignant hyperthermia
- Increased cardiac output (during resuscitation)
- Bicarbonate infusion
- Tourniquet release
- Effective drug therapy for bronchospasm
- Decreased minute ventilation

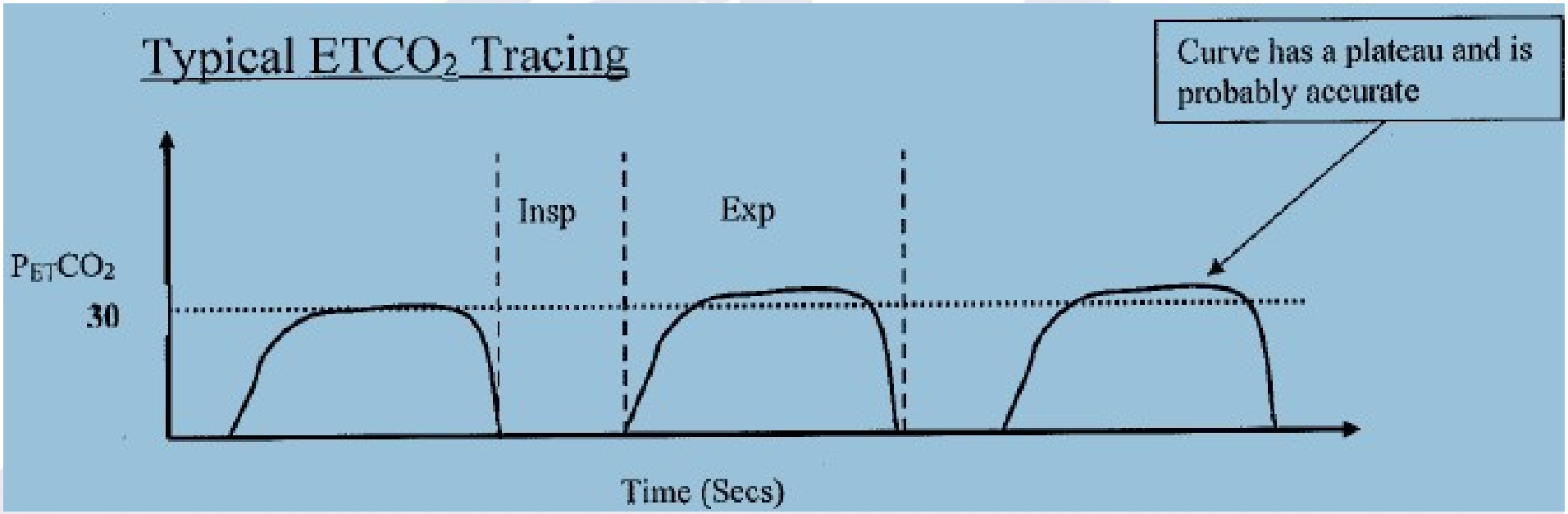
Physiologic factors affecting $EtCO_2$ levels:

Decrease in $EtCO_2$

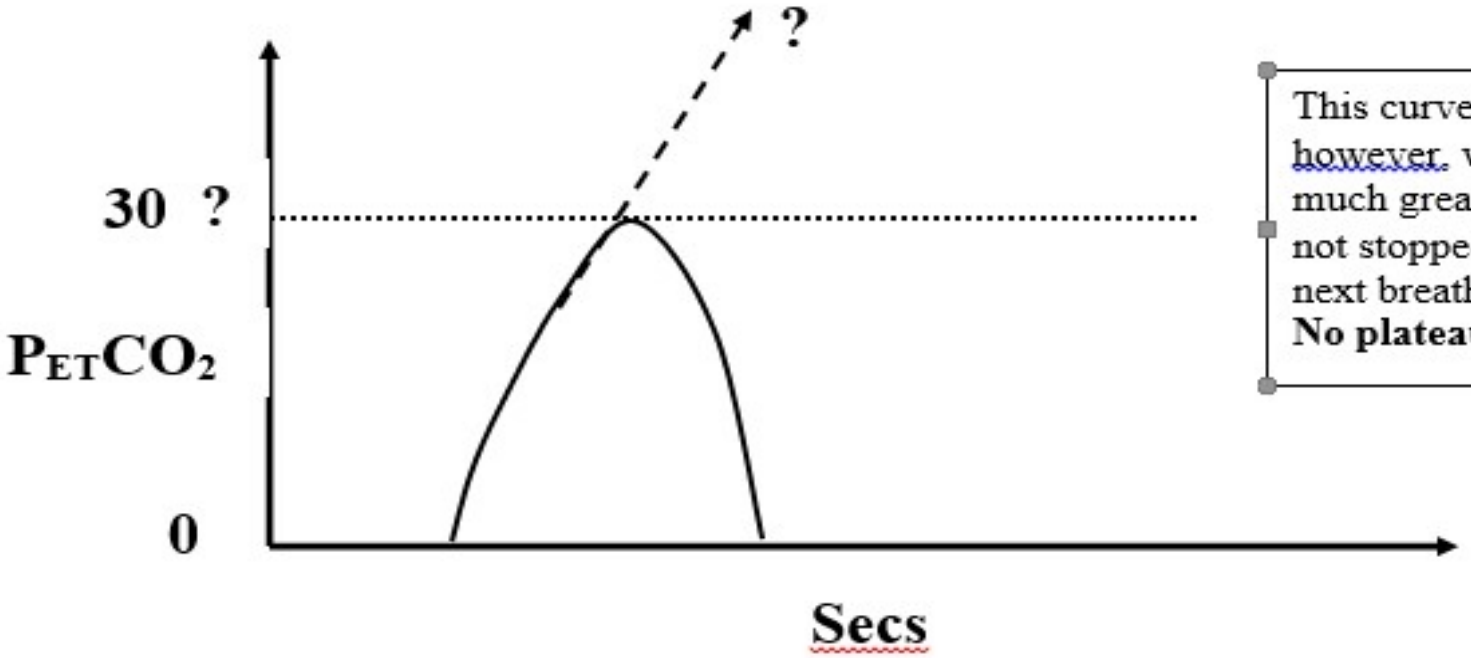
- Decreased muscular activity (muscle relaxants)
- Hypothermia
- Decreased cardiac output
- Pulmonary embolism
- Bronchospasm
- Increased minute ventilation

Steps to Success with $EtCO_2$

- ✓ Check for plateau on the waveform
- ✓ Whenever possible, corelate with a P_aCO_2



Waveform often seen; not accurate numbers!



This curve shows $P_{ET}CO_2 > 30$, however, we don't know how much greater as the $P_{ET}CO_2$ has not stopped rising before the next breath.
No plateau, Not accurate

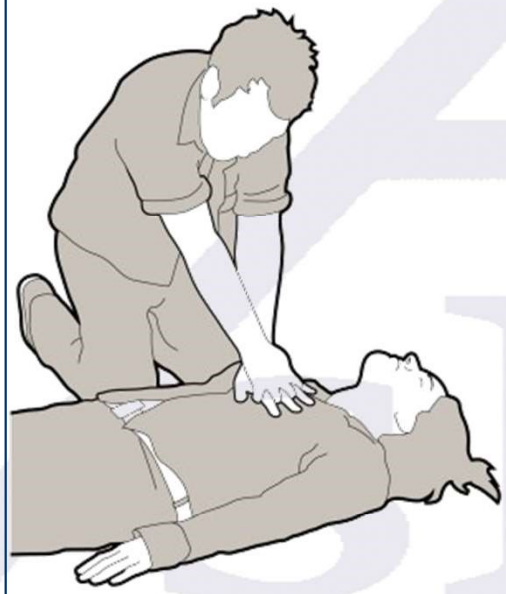
P_ECO_2 Interpretation –

Condition #1	Waveform plateau present and P_ECO_2 correlates with a P_aCO_2	Good for assessment of changes in minute ventilation.
Condition #2	Waveform plateau present and P_ECO_2 much lower than P_aCO_2.	Good for assessment of changes in V_D/V_T and trending changes in minute ventilation
Condition #3	Waveform does not plateau	Not accurate; marginal for trending minute ventilation; Useful for monitoring effectiveness of CPR

REVIEW

1. Check for plateau on the waveform
2. Correlate with P_aCO_2 if possible
3. Always *THINK* about implications

$EtCO_2$ and Cardiac Arrest



The capnograph of an intubated cardiac arrest patient is a direct correlation to cardiac output

Increase in CO_2 during CPR can be an early indicator of ROSC (Return of Spontaneous Circulation)

Termination of Resuscitation

EtCO2 measurements during a resuscitation give you an accurate indicator of survivability for patients under CPR

Non-survivors <10 mmHg

Survivors (to discharge) >30 mmHg

ET Tube Verification

- Verification of proper tube placement

no waveform = no tube!!!

There is simply *NO BETTER WAY* to confirm proper tube placement than with waveform capnography.... PERIOD!!!