The Capnograph

The capnograph monitors breathing by measuring exhaled (end tidal CO_2 or $etCO_2$) and inhaled carbon dioxide ($inspCO_2$). $EtCO_2$ and $inspCO_2$ values change during each breath cycle.

$EtCO_2$ approximates arterial levels of CO_2 measured in millimeters of Mercury (P_aCO_2 in mm Hg).

Capnograph design options:

Sensor in breathing circuit (mainstream sampling) **OR**
gas sample from trachea delivered to a remote sensor (side stream sampling).

CO_2 values are displayed digitally as well as graphically as a function of time on an oscilloscope screen.

If you use mainstream sampling:

The capnograph has a very rapid response time and displays the patient's breathing cycle and carbon dioxide levels in real time without delay.

It is more accurate in small the patient because there is no dilution effect caused by sampling.

However the weight of the sensor predisposes to accidental extubation and these units are more expensive.

The sensor adds dead space to the breathing circuit and the smaller the patient the more significant this dead space is. There are adult and pediatric sensors, but even the pediatric sensors add excessive dead space for birds.

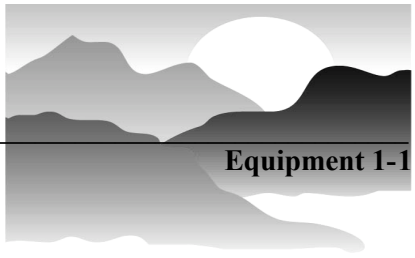
If you use sidestream sampling:

The ETT adaptor is more lightweight and is compatible with MRI. There is a delay in recording what is actually happening to the patient as it takes time for the breath sample to travel to the monitor, so breathing and the capnograph display are slightly out of sync by 2 to 3 breaths.

The unit may sample an excessively large amount of gas relative to the patient's breath size. The smaller the patient the more this reduces the accuracy of the capnograph causing the $etCo_2$ to be underestimated.

The more rapid the breathing rate the less the capnograph will represent what is actually taking place and the wave form loses some of its diagnostic usefulness.

Sampling tubes may become obstructed with water, blood or secretions.



The Capnograph (Cont'd)

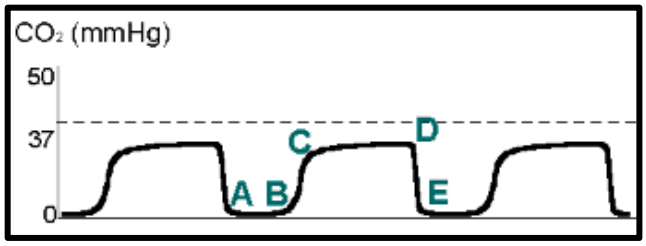
The shape of the CO_2 graph

The normal capnograph display:

Normal etCO_2 levels: 35 to 45 mm Hg, usually 3 to 5 mm Hg lower than P_aCO_2.

Normal capnograph display:

A to B	The time between the end of inhalation and the beginning of exhalation
B to C	Exhalation
C to D	Expiratory plateau, the time between exhalation and inhalation
D	Point of measurement of etCO_2
D to E	Inhalation



The normal CO_2 waveform diagram

The shape of the CO_2 curve provides useful information about:

- Placement of the ETT (esophageal, endobroncheal)
- Leaks around ETT cuff
- Functioning of the circle absorber and unidirectional valves
- Appropriateness of the oxygen flow rate for a non-rebreathing anesthesia circuit
- Apnoea
- Hypoventilation
- Hyperventilation
- Airway obstruction/bronchospasm
- Cardiac arrest

See page 4-29 for interpretation of abnormal capnograph wave forms.