Capnography Demystified

(In stereo)

Please turn your speaker volume up.

Use the navigation buttons to progress to the next slide.

Some terms:

Capnography

The measurement of exhaled carbon dioxide levels

Capnograph

A device that provides a numerical reading of exhaled carbon dioxide as well as a tracing (similar to an ECG).

Some terms:

Side Stream Capnography

Can be used in both intubated and non-intubated patients, and is designed to permit precise measurement of carbon dioxide levels, even in patients on low flow oxygen.

End Tidal CO2 (ETCO2)

The partial pressure (level) of carbon dioxide released at the end of expiration.

Physiology

Oxygenation

The process of getting oxygen into the body and the tissues.

Physiology

Ventilation

Is the movement of air and is how we get rid of carbon dioxide.

The wave form

Normal

The normal range for exhaled carbon dioxide is 35-45 mmHg.
Segment I (A to B) of the wave represents post inspiration / dead space expiration.

Segment II (B to C) of the wave represents exhalation upstroke where dead space gas mixes with alveolar gas.

Segment III (C to D) of the wave represents a continuance of exhalation and is also called the plateau.

Segment IV (D to E) of the wave represents inspiration washout.

The height of the wave should be compared to the scale on the page / screen to determine ETCO2 levels.

The number of wave forms per minute can be counted to get an accurate respiratory rate.

The waves should be analyzed to see if there is any difference from the expected squared off wave form.

Changes in the height of the waves during monitoring should also be evaluated.
When a person hyperventilates their carbon dioxide goes down over time.

When a person hypoventilates their carbon dioxide level goes up over time.

Continuous end-tidal CO2 monitoring in conjunction with other confirmatory devices / examinations can help to determine tube placement.

If the end-tidal CO2 levels are zero after intubation the tube may be in the esophagus.

There are exceptions.

The capnograph can be attached to the endotracheal tube prior to intubation in those cases that it is difficult to visualize the cords. A registering of CO2 on the monitor after placement will indicate that you are in the trachea.

During CPR you may pick up waveforms with compressions.
Cardiac Output can be gauged by capnography.

**Clinical Applications**

Cardiac Output

- Stroke Volume
- Heart Rate
- Amount of CO2 delivered to the lung

**Cardiac Output / CPR**

An increase in CO2 can indicate a return to spontaneous circulation. This would be confirmed by a pulse check.

**Clinical Applications**

ROSC – spike in the CO2 readings

**Return of Spontaneous Circulation**

Loss of spontaneous circulation

Because end-tidal carbon dioxide monitoring is a better indicator of ventilatory status, breathing difficulties in sedated patients can be detected more quickly by monitoring ETCO2 as opposed to SPO2 which is slower to respond to ventilatory changes.

**Clinical Applications**

**Sedated Patients**

Remember back to segment BC in the diagram. In the normal patient, the ascent of the line is rapid as the dead space gases mix with the alveolar gas.

In the patient with acute bronchospasm, the ascent will be delayed as there is a struggle to release the alveolar gases and the result is uneven alveolar emptying.

This creates the characteristic shark fin appearance to the wave.

**Clinical Applications**

Asthma / COPD

**Clinical Policy**

Intubated Patients

Patients who have received sedation

Bronchoconstrictive / CHF

**Indications**
Clinical Policy

If you use the ETCO2 monitor on a patient, you need to include a printed strip with your patient documentation.

Zoll Device

The LoFlo module has been attached to all the monitors. This device can monitor both intubated and non-intubated patients with the use of the 15/22mm adaptor or sampling cannulae (which are disposable devices). The device's sample cell (connector) is placed in the sample cell receptacle in order to obtain readings.

The LoFlo module should remain attached to the monitor. As long as the module is attached, no zeroing is required. The exhaust tube of the module should vent the gases away from the module. There will be an initial "warm up" period when the machine is first turned on. The sampling device can be attached during the warm up period.

If the device has been removed and needs to be zeroed, follow these steps:

1.) A ETCO2 device needs to be connected to the module in order to zero it.
2.) Make sure that the device is not near any source of CO2 (the patient, you or the exhaust tube).
3.) Press the Param. soft key.
4.) Select the ETCO2 options.
5.) Press the Zero soft key.
6.) Press enter.

Numerical reading of ETCO2

Wave Form Tracing
**Alarms**

Alarms can be set manually or to the “auto” setting.

**Summary**

Sidestream ETCO2 monitoring is a very effective way to evaluate a patient's ventilatory status and cardiac output.

ETCO2 waveforms can be evaluated to aid in the assessment of certain respiratory distress patients.

ETCO2 is a useful assessment tool to assess for:
- Hypoventilation
- Hyperventilation
- Intubation placement and patency
- CPR effectiveness
- Return of spontaneous circulation
- Bronchoconstriction

When ETCO2 is measured on a patient it should be documented on your PCR and a printed strip should accompany your run report.

**Questions**

If you have any questions about the use of the capnograph please feel free to contact the Clinical Coordinator:

Dana Sampson
dana.sampson@patriotambulance.com

**References**


Krauss, B. *Capnography in EMS: A powerful way to objectively monitor ventilatory status*. JEMS, January, 2003


**Zoll Device**

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<th>Respiration Rate Average</th>
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<th>Low Limit</th>
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