Uses of Capnography
*The Microstream™ Method*

Application Note

Introduction

This application note summarizes the uses of capnography in a pre-hospital and emergency environment. It also describes the Microstream™ method for End-tidal CO₂ (EtCO₂) measurement and details the advantages of this technology compared to other measurement methods.

What is Capnography?

Capnography is the measurement and numerical display of End-tidal CO₂ (EtCO₂) or the maximum expired CO₂ concentration during a respiratory cycle. The capnograph is the graphical representation of the concentration or partial pressure of expired CO₂ during a respiratory cycle in a “waveform” format. The capnograph provides information not only regarding pulmonary function, but also indirect cardiac function, ventilator function and perfusion.
In the operating room, EtCO₂ monitoring is already the standard of care. In pre-hospital use, capnography is beneficial in the following situations:

- verifying endotracheal, rather than esophageal, intubation
- continuous monitoring of the airway, post intubation and during transport
- assessing the effectiveness of cardiopulmonary resuscitation (CPR)
- assessing cardiac output in patients with pulseless electrical activity
- assisting in the decision to cease resuscitation in patients with pulseless electrical activity
- helping to assess the severity of respiratory distress and ventilatory fatigue (CO₂ retention)
- helping to assess the degree of circulatory failure in shock from any cause
CO₂ Monitoring Methods

There are two methods for obtaining a gas sample for CO₂ monitoring. In a mainstream system, the sensor is located directly in the patient’s breathing circuit; in a sidestream system, a sample is removed from the patient’s airway and delivered to a distant sensor.

Both of these methods have disadvantages. Dealing with the moisture and patient secretions present in the airway is a general problem which often results in additional parts (such as water traps) and additional tasks for the user.

With the mainstream method, the CO₂ adapter and sensor are mounted directly in the patient’s airway, on the endotracheal tube. This means that this method can only be used for intubated patients, and because of the weight of the sensor, it is not optimal for neonates or infants.

The sidestream method allows use with non-intubated patients, however, the minimum sample volume required is between 100 and 150 cc which is too high for neonatal patients.

The Microstream™ Method

The Microstream method of CO₂ measurement avoids the problems associated with the two methods previously described.

The Microstream method allows use with nonintubated patients (with the nasal cannula) and, due to the low sample volume of 50 cc, also allows use with neonates.

The sample is obtained from the center of the lumen of the airway adapter. This prevents ingress of condensed water and patient secretions into the FilterLine independent of the position of the sampling port, because water and patient secretions accumulate at the wall of the airway adapter due to gravity and adhesion.

The multiple small diameter openings in the center of the lumen of the airway adapter, the FilterLine design and the very small sample cell result in a very crisp CO₂ wave, fast rise time and suitability for respiration rates up to 150 rpm.

The airway adapter design and a hydrophobic filter inside the FilterLine avoid the requirement for a water trap and allow the instrument to be used in all orientations.

In addition, the Microstream method requires no calibration before use and has an extremely short warm-up time facilitating its use in emergency situations.

Although ideal for short-term use in pre-hospital and emergency situations, the Microstream method is not limited to such applications. Used with the specially designed long-term accessories, the Microstream method provides a cost-effective and efficient solution for EtCO₂ monitoring in the ICU.
Summary

The Microstream technology, with all its advantages, can greatly further the clinical usage of capnography. It can be used on all patients, independent of age and intubation status. It is equally suited to outpatient and inpatient use in all areas of the hospital.

By providing essential diagnostic data in difficult situations it can potentially improve patient care while remaining highly competitive in the area of efficiency and cost-effectiveness.