The Control of End Tidal CO2

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Introduction

Pre-hospital care can be defined as efforts to achieve or maintain homeostasis. The ability to monitor and control CO2, a key component of the buffering system, is an essential means to that end. Because CO2, a key component of the buffering system, has a direct effect on the pH of the body, the ability to monitor and control End Tidal CO2 (ETCO2), is essential in order to maintain homeostasis.

Recently the American Heart Association has issued new guidelines defining a narrow range of optimal oxygen saturation for many situations. Based on these recommendations proper patient care mandates that we have the ability to control both components of ventilation. This pilot study examines the feasibility of controlling the End Tidal CO2 during 911 ground ambulance operations.

Materials and Methods

There were 2 ventilation adjuncts available, the choice of either was not defined or dictated by the protocol and was the clinician's choice.

The control: an adult bag valve mask (BVM) as manufactured by Life Support Products #L770 with a bag volume of 1488 ml, valve dead space of 7.8 ml (not including mask) and a patient connection of 22 mm outside diameter, 15 mm inside diameter with no pop off valve.

The study: An oxygen powered disposable PIP cycled automatic resuscitator that regulated: Respiratory Rate, Tidal Volume, Peek Inspiratory Pressure (PIP). Peak End Expiratory Pressure was variable at 20% of the selected PIP. The VAR-Plus model PCM (VORTRAN Automatic Resuscitator) was used.

In December of 2009 Stamford EMS Paramedics began a program of training using manufacturer's competency requirements and guidelines from the FCCS course curriculum. Clinical targets were FiO2 of 100% at a rate of 10-12bpm and a PIP range from 20-25cm/H2O. Paramedics were not restricted to these targets and were instructed to vary settings to meet the patients' needs.

ETCO2 was monitored via Side-Stream filter line Capnography as manufactured by Microstream and available on the Lifepak 12s currently in use.

January through September of 2010, 152 intubated patients were reviewed. 46 met the criteria of any patient greater than 10 kg with an intrinsic pulse and in respiratory arrest whether idiopathic or clinician induced as an example from Rapid Sequence Induction. One patient was excluded due to a metabolic aberration. The remaining cases were split, with 1,012 specific ETCO2 samplings evenly distributed over 23 cases using a BVM (as the control) and with 1,270 specific ETCO2 samplings evenly distributed over 22 cases using the VAR. The first 4 minutes of data records from all cases were excluded to compensate for procedural anomalies experienced while securing the airway.

Data for all cases in each group were combined for the calculation of standard deviation (Sd). The Sd was also calculated for each individual case. The difference in the quantity of records had no statistical significance on results in a test analysis.

Results

After 9 months, ETCO2 values in the control group reflected a Standard deviation of 16.97 while the test group ventilated with the VAR reflected a standard deviation of 14.09. In addition the test group trended lower as time progressed while the control group did not.

Conclusion

Although data is still being collected, these initial values show that despite the dynamic environment of the pre hospital setting, with a minimum of additional training the pre-hospital provider can more accurately control ETCO2 with a disposable PIP cycled respirator than with a Bag Valve Mask.

Sources

- Stamford Emergency Medical Services – Stamford CT.
- Vortran Medical Technology 1, Inc. – Sacramento CA.
- Fundamentals of Critical Care Support fourth edition – Society of Critical Care Medicine
- Lifepak 12 as manufactured by Physio-Control Inc. – Redmond WA.

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