UNCONTROLLED VENTILATION: An Acceptable Standard of Care?

Due to the work of Aufderheide[1][1A][3] and others the lethal effects of hyper-ventilating patients during resuscitation is now understood, and has been addressed in the new AHA Guidelines[2] which recommend a reduced number of respirations per minute. Dr. Aufderheide found in one study that the average pre-hospital ventilation rate provided was 37 breaths per minute, almost three times higher than what was then taught! After CPR *retraining* the ventilation rate provided by the rescuers still averaged a potentially lethal 22 breaths per minute. Can we now feel assured, simply because new guidelines have been established, that they will be rigorously followed? When adrenalin pumps, it seems, training may be forgotten.

Consider this direct quotation[1]

> The consistent and inadvertent hyperventilation observed in this study by trained, retrained, and certified professional rescuers demonstrates a significant difference between CPR performance in the classroom and CPR performance during an actual cardiac arrest. As such, this study indicates that there are significant patient safety issues when it comes to the delivery of CPR. It also highlights a potential direct relationship between the quality of CPR delivered and victim survival.

In other words; when actually performing CPR rescuers need feedback to help them provide the correct ventilation, and thereby improve their patient's chance of survival.

And is avoiding *hyper*-ventilation the only problem that must be avoided? If we assume the rescuer delivers a lesser number of breaths in accordance with the new guidelines, and there is significant leakage around the face mask or elsewhere (as there often is) or the BVM is not functioning properly (as is sometimes the case) the patient's alveolar ventilation may be much less than the rescuer thinks, resulting in significant hypoxia. It should be remembered that as the tidal volume actually received by the patient is reduced, the *effective* ventilation, i.e. the *alveolar ventilation*, is reduced by a disproportionately greater amount (due to the patient's anatomical and alveolar dead space). Inadequate oxygenation can be catastrophic, particularly if the patient sustained traumatic brain injury (TBI).

To quote again[4]

> The importance of not allowing the TBI patient to suffer from a hypoxic event cannot be overstated. — Hypoxia in the brain-injured patient often leads to devastating damage in already fragile brain tissues and can drastically increase morbidity and mortality. The damage caused by even the shortest hypoxic event is often not evident at the time of the event but appears several hours or even days later.

For these and other reasons it is of paramount importance to control not only the respiration rate but the *expired* tidal volume and minute volume as well. That is, to control the level of ventilation *the patient is actually receiving*. Detection of inadequate oxygenation by means of pulse oximetry is not a satisfactory substitute for ventilation control, as hemoglobin desaturation provides a relatively late sign of trouble and is unspecific as to cause. For example, would we wish to rely solely on pulse oximetry to alert us to esophageal intubation?

As we cannot control what we do not measure, the importance of the Exhalometer becomes evident. It is a small, inexpensive, FDA cleared instrument which fits onto the expiratory port of the resuscitator and displays, in addition to the respiration rate, each *exhaled* tidal volume and the minute volume as well. This provides the rescuer the information needed to accurately and conveniently supply the appropriate ventilation.

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If, when manual resuscitation devices (MRDs) first became available, they were able to show the actual lung ventilation being provided to the patient no one would suggest today that that was unnecessary information.

The ability to know and control the gas volume the patient is actually receiving, when being ventilated with a MRD, should be recognized as being just as important a requirement as it is when they are being ventilated with any other type of ventilation device. Today, the Exhalometer makes that requirement easily achievable.

Our present practice of supplying unknown and uncontrolled ventilation to critically ill patients should no longer be accepted as a standard of care.

References

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(2) 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, *Circulation*, 2005; 112(suppl 1V)

(3) Forecast for RESUSCITATION: Highlights from the 2004 EMS State of the Science Conference; Dallas, Feb 20-21, 2004.

(4) Rosner, G. Combat Hypoxia; The importance of airway management and oxygenation of the traumatic brain injury patient: *JEMS*, March 2003