

Physician! "First, Do No Harm!" The need for Controlled Ventilation in Emergency Care

It is widely believed that the phrase "Physician, first do no harm" comes from the Hippocratic Oath taken by physicians when they enter medical practice. While the oath (when translated from the original Greek) does not contain this exact phrase, it does state:



"I will prescribe regimens for the good of my patients according to my ability and my judgment and never do harm to anyone".

All clinical practice should be based on sound scientific research. While the majority of practices are undertaken on this basis, there are some that are perpetuated by a lack of a significant alternative to current practice. One such practice is manual or "Bag-Valve-Mask" (BVM) ventilation.

Developed in 1954 by Henning Ruben in Copenhagen/Denmark, the original self-inflating bag (which he had made by his bicycle mechanic by welding together four spokes from a bicycle wheel and inserting them into a black anaesthesia bag) has changed very little since that time. In 1964, the self-inflating bag was declared by the American Medical Association to be among the most significant medical advances in anaesthesia of the past 25 years.

While there are many different makes of Bag-Valve-Mask devices currently available, they do not differ much in their performance. Certainly, in the early days of CPR the "Ambu Bags" (so named after the first commercial manufacturer) or manual resuscitators as they are more appropriately called, were the only available adjuncts for the rescuer which did not require the use of an exhaled breath, or a source of compressed oxygen to ventilate the patient. As such, they were without a doubt a significant advance in emergency respiratory care. However, considering the major advances in medicine that have taken place over the

last 50 years, we are still, in the most part, relying on 65 year old technology to perform the key task of oxygenating a respiratory/cardiac arrest patient.

In the majority of user's hands, the physiological effects on the patient that manual resuscitators can have are significant and can create many problems for the patient and the rescuer, including:

1. **Aspiration of stomach contents**
2. **Reduced venous return to the heart**
3. **A subsequent decrease in cardiac output**
4. **Reduced coronary perfusion pressure**
5. **Increased brain ischemia**

These issues are caused by what is now termed -

"Inadvertent Hyperventilation",

providing ventilations at too high a minute volume with short inspiratory times, high ventilation rates and high peak airway pressures.

There is significant evidence to show that standard manual resuscitators can be somewhat ineffective in providing good quality ventilation and may possibly be potentially dangerous. In fact, as far back as October 1992, The American Heart Association "Guidelines for CPR" published in the Journal of the American Medical Association clearly identified that these devices were generally ineffective in providing adequate ventilations to the patient. A wealth of clinical evidence to support this, and other statements by the American Heart Association, has been accumulated over the past 30 years.

Aufderheide's paper in 2004 entitled "Hyperventilation-Induced Hypotension During Cardiopulmonary

Resuscitation" (Circulation 2004;109:1960-1965) stated that:

".... any incidence of hyperventilation is likely to have detrimental hemodynamic and survival consequences during low flow states such as CPR".

This paper clearly showed that even trained paramedics hyperventilate patients when under stress, even immediately post training, and this hyperventilation has serious deleterious effects on the patient. This led to Pitts and Kellerman's statement in The Lancet 2004;364 that:

"Unrecognized and unintentional hyperventilation may be contributing to the currently poor survival rates from cardiac arrest".

A further study by O'Neill and Deakin (Resuscitation 2007;73:82-5) entitled: "Do we hyperventilate cardiac arrest patients"? reiterated the points made by Aufderheide et al stating:

"Hyperventilation was common, mostly through high respiratory rates rather than excessive tidal volumes. This is the first study to document tidal volumes and airway pressures during resuscitation. The persistently high airway pressures are likely to have a detrimental effect on blood flow during CPR. Guidelines on respiratory rates are well known, but it would appear that in practice they are not being observed".

For patients suffering from traumatic brain injury (TBI) The American College of Neurosurgeons in their Guidelines for the Management of Severe Head Injury (© 1995 Brain Trauma Foundation) stated that:

"Hyperventilation in brain injured patient's increases brain ischemia".

So the issue of inadvertent hyperventilation has far reaching effects, not only on survival but also on neurological outcomes.

For many years it could be stated that manual resuscitators were the only readily available, easy to use products for providing positive pressure ventilation. However, this has not been the case for over 30 years since the first oxygen powered, time cycled, automatic transport

ventilators came on the market. These devices do have limitations in that they require a source of compressed gas (medical air or oxygen) to run them, which limits the accessibility of the products to every area where they may be required, their effectiveness in providing good quality ventilations is however the "Gold Standard" in emergency ventilation.

Mouth-to-mouth barrier devices and "pocket mask" type products, while providing a degree of protection from cross infection for the rescuer, are certainly not seen as a replacement for the BVM by the healthcare profession. Indeed, their overall efficacy, including the low O₂ concentration, high ventilation pressures generated and reluctance of the rescuers to actually use the devices for fear of cross infection, make them a "last resort" product for many rescuers.

While the issue of "inadvertent hyperventilation" does seem to be prevalent in the industry, there is salvation in the form of the O-Two Medical Technologies Inc. SMART BAG® MO. This technologically advanced BVM offers the rescuer the ability to provide controlled ventilations while drastically reducing the risks associated with standard BVM ventilation.

Today and in the future, this new, "controlled flow", manual resuscitator is assisting physicians in their quest to

"FIRST, DO NO HARM!"