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Articles

“The Problem of Inadvertent Hyperventilation” - Resolving With Technology Part II

The problem of Inadvertent Hyperventilation during CPR (caused when bag-valve-masks are squeezed too hard and/or too fast in an unprotected airway) is a significant problem that can lead to serious consequences for the patient. In Part I of this series on Inadvertent Hyperventilation – Resolving the Problem with Technology, we reviewed the SMART BAG® MO that addresses the hyperventilation issue by controlling the flow from the balloon based on how the rescuer squeezes it. We will now take a look at a second technical resolution for EMS Personnel – Automatic Transport Ventilators or ATVs.

ATVs automatically provide controlled ventilation rates (breaths per minute), tidal volumes and airway pressures. It is virtually impossible to inadvertently hyperventilate a patient with an ATV. The rescuer simply sets the rate and volume based on the patients' size, manages the airway and the ATV provides the proper ventilation.

Since 1992 the AHA has been recommending the use of ATVs as the most effective method of ventilation in the emergency pre-hospital market. According to the Resuscitation Guidelines:

- ATVs are superior at maintaining constant minute ventilation and adequate arterial blood gases
- ATVs provide improved lung inflation with diminished or absent gastric insufflation.
- ATVs free the rescuers hands for other tasks in intubated patients and for mask & airway maintenance in un-intubated patients.

If the patient receives better ventilation and the rescuer's job is easier, why are BVMs still the device of choice for EMS? It likely comes down to familiarity, costs and a perception of the dangers of ATVs based on experiences with very early manually triggered devices. BVMs have been used since the 1950s and virtually all ventilation training has been focused on the quality and frequency of the squeeze. Rarely are EMS Personnel trained on automatic ventilators or even introduced to them.

From a cost standpoint, to acquire ATVs does mean tapping into capital budgets (although leasing/renting may address this). On a per-patient cost basis however, ATVs can actually be the same or less expensive. If as little as two disposable BVMs are used on a vehicle per month, a basic ATV could be a more cost effective solution.

An article in the Respiratory Therapy Journal, when discussing automatic ventilators, stated *“their initial purchase price exceeds that of all other transport ventilation methods, but the cost per patient is similar to that of the BVM”*. Most ATVs also use 1/3 less oxygen than a BVM connected to a free flowing oxygen source. They deliver oxygen on demand or only when required versus a constant 15-30 L/Min flow.

There is also misinformation out on oxygen powered resuscitators based on some of the first manually triggered devices introduced to the market over 30 years ago. One perception is that they can “blow up a patient's lungs”. Pressure relief valves prevent this from happening and the reality is that this is more probable with a BVM. Most adult versions do not have a pressure relief mechanism and the rescuer tends to squeeze the BVM harder when lung compliance increases. Other protective features, like a controlled flow rate, make the ATV a safer device for ventilation.

BVMs will never be completely replaced by ATVs as they can operate without oxygen or compressed air – ATVs cannot (some even require batteries). With an open mind to change however, ATVs can provide patient benefits, ease of use for rescuers (and free hands/personnel) and possible savings on a cost-per-patient basis.