

Normocapnea: a bag-valve device versus the Oxylator® FR-300

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INTRODUCTION

Ventilating patients with a bag-valve (BV) device on mask or endotracheal tube has been demonstrated to be haphazard even in experienced hands. Severe adverse outcomes have been described.

The Oxylator® FR-300 (a first responder resuscitator) has been introduced to simplify and improve outcome during emergency ventilation.

AIM OF THIS STUDY

This study was designed to evaluate potential improvement in ventilation with the Oxylator® FR-300, with regard to establishing and maintaining normocapnea (ETCO₂) compared with the BV device.

PATIENTS AND METHODS

Firemen were recruited and given three hours of theory and practical training on manikins. They were told to achieve and maintain a free airway and normocapnea (AHA guidelines), and distracted.

Patients scheduled for elective general anesthesia were recruited. After induction of hypnosis (H) a bag-valve followed by the Oxylator® in manual (Oxy-m) and automatic (Oxy-a) mode were used to ventilate with mask. These three steps were repeated after addition of muscle relaxation (HC), first with the mask and again after placement of the endotracheal tube (ETT).

The fireman ventilating was blinded for the Datex-Ohmeda M-COVX spirometer monitoring and for the flow (24 L/min or 30 L/min) of the Oxylator®. The working pressure was 20 cmH₂O in all cases. Per protocol, ventilation was cut off if the inspiration time was excessive. ETCO₂ was kept \geq 18 mmHg. Time was allowed for return to normocapnea between steps as needed.

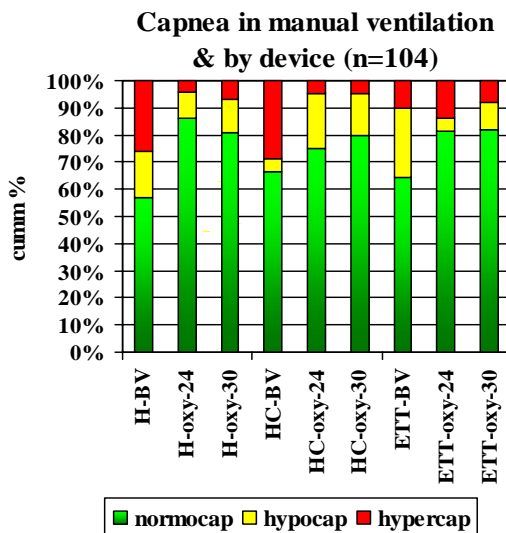
Data are reported as mean \pm SD. Statistics were performed with SPSS (v9) using repeated-measures analysis of variance.

RESULTS

104 patients completed the protocol. The mean age was 49 \pm 17 years old (range 18-91). Weight varied from 48 to 132 kg (76 \pm 15.1 kg). 47% was male.



ETCO₂ as defined by normocapnea (30 - 45 mmHg) is shown below. Note that in the Oxy-24 and -30 categories 47 and 57 patients are represented respectively, while all patients were ventilated with the bag-valve device. There is a strong improvement in the Oxylator® groups ($p < 0.01$).



ETCO₂ data were used only when inspiratory and expiratory volumes approximated each other. The ETCO₂ curve was visually monitored.

DISCUSSION

The Oxylator® FR-300 has been suggested to be a useful resuscitator / ventilator, improving efficiency. Bag-valve devices are notoriously difficult to use even in professional hands.¹

Little is known about the optimal relation between working pressure and flow in facilitating a patent airway. As early as the 1970's flow reductions have been advocated.²

We observed that, under carefully controlled clinical "lab" conditions, using the FR-300, 24 L/min and 30 L/min and both 20 cmH₂O, extremes in tidal volumes were avoided. No more than a tendency towards hyperventilation was noted with the 30 L/min device. This collaborates earlier work from our clinic.³ Achieving the desired 2 second inspiration time seems to go well without attention.

Use of the Oxylator® in manual and automatic mode seems possible for a long(er) period. In our study 35 minutes was the longest period of uninterrupted Oxylator® ventilation in automatic mode and with monitoring.

CONCLUSION

We found that the Oxylator® FR-300 has a high efficacy and efficiency when used by first responders to achieve and maintain normocapnea under clinical and controlled conditions ($p < 0.01$).

Minimal training seems sufficient for safe use by first responders. A wide weight range of patients can be treated adequately.

1: Braman SS, *et al.* Ann Int Med 1987; 107: 469-473

2: Standards for CPR and ECC, JAMA 1974; 227(7): 833-868

3: Dun van PJM, *et al.* Resuscitation 2000; 45(1):S18