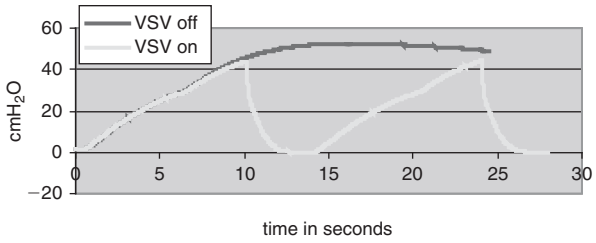
The airway alarm and the APL valve are set at their maximum level. At time zero the ventilator is switched to a manual ventilation mode without compression of the balloon. The airway pressure is monitored.

In a second test the ventilator is set to its lowest ventilation frequency and its largest I/E ratio in the controlled volume ventilation mode. Tidal volume is set at 750 ml. Failure of the device is stated as opening of the valve during ventilation.

Results and Discussions: Graph 1 shows the airway pressure of the first test. The device releases air and prevents a pressure of more than 22 cmH_2O to take place longer than 6 sec. In the second test the safety valve opened only when inspiratory-expiratory ratio was 1:1 or 2:1 and ventilation rate was less than 5 cycles per minute. The settings of long inspiratory periods for large tidal volumes in small lungs is never used.



Conclusion: The device does not disturb the ventilation when inserted into the breathing circuit.

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Improved ventilator safety valve tested in vivo

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Background and Goal of Study: The characteristics of a new ventilator safety valve (VSV) are given in a previous abstract. Safety valve opens when pressure exceeds 20 cmH_2O for more 6 seconds. This new VSV protects against prolonged increases in airway pressure. However does it interfere with some manual ventilation modes where a need for prolonged increased airway pressures exists? Goal of the study was to use the safety valve during difficult manual facemask ventilation and during manual squeezing of the lungs after extra corporeal circulation (ECC) where prolonged airway increases are needed.

Materials and Methods: The safety valve is inserted in the breathing circuit. Fresh gas flow was set at 10 liters/min and the adjusted pressure limiting valve (APL) was turned to maximum during manual ventilation. Airway pressure and safety valve function were recorded during the measurements. A first group of ten male patients was chosen due to an expected difficulty for manual face mask ventilation based on an elevated BMI and having a beard. No clinical need for a rapid sequence induction existed. Muscle relaxation was achieved with cisatracurium 0.1 mg/kg given after loss of consciousness.

A second group of 10 patients needed an ECC and had during controlled mandatory ventilation peak airway pressures above 30 cm H_2O to obtain normal end-tidal CO_2. Manual squeezing was needed until total visual expansion of the lungs at the end of the ECC. Maximum time of airway pressures above 20 cmH_2O and opening of safety valve is noted during manual ventilation or squeezing. Approval from the hospital ethical committee was obtained for both groups.

Results and Discussions: The safety valve never opened in the first and second group of patients. The maximum time of airway pressures continuous above 20 cmH_2O was never longer than 3 seconds in both groups. (A mean of 0.6 seconds with a stdv of 1.2 in group 1 and a mean of 1.3 seconds with a stdv of 0.8 in group 2). The 6 seconds of the VSV was a lot longer than what is clinical necessarily in both groups.

Conclusion: The safety valve never interfered with manual ventilation during induction or during squeezing of the lungs.

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Comparing the effectiveness of two different oxygen face masks

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Background and Goal of Study: Different oxygen face masks have a varying efficiency resulting in a different oxygen flow per minute to achieve similar oxygenation. The goal of this experimental trial was to compare an improved oxygen face mask model ($HiOx^{80}$, VIASYS Healthcare, Germany) to a standard oxygen mask (Intersurgical Ltd., UK) and to evaluate oxygen flow per minute required to prevent desaturation.

Materials and Methods: After approval of the local ethics committee and informed consent, volunteers were randomly assigned to two groups (Group S: standard mask; group H: $HiOx^{80}$ facemask). During a standardized climbing profile in an airplane (Pilatus PC-6) to an altitude of 22,500 ft (6,863 m), the oxygen flow was individually controlled to result in a mean oxygen saturation (SpO_2) of 95 to 97% as determined by pulse oximetry. Oxygen flow, oxygen saturation, and pulse rate were obtained every 1000 ft (305 m). Mann-Whitney-U-Test was used for statistical analysis, a $P < 0.05$ was considered significant.

Results and Discussions: 31 Volunteers (3 female, 28 male, mean age 38.9 ± 7.7 years) participated up to an altitude of 22,500 ft. Between group S (14 male, age 39.4 ± 8.4 years) and group H (3 female, 14 male, age 38.0 ± 6.4), the pre-trial parameters age, lung function indices, heart rate, and SpO_2 were comparable ($P > 0.05$). Mean in-flight SpO_2 between group S (95.3 ± 0.5%) and group H (96.2 ± 1.1%, $P = 0.78$) was comparable as well. Above 13,000 ft, group H required less oxygen flow compared to group S ($P < 0.05$), at 20,000 ft and 22,000 ft oxygen flow was comparable.

Conclusions: When using $HiOx^{80}$ facemasks, oxygen rate is reduced compared to a standard oxygen facemask. This effect is of importance at an altitude of 13,000 ft or above. Using a $HiOx^{80}$ facemask reduces the total oxygen consumption as well as costs and extends oxygen availability (e.g. with a oxygen pressure bottle) and may have importance for perioperative anesthesia, emergency medicine, and intensive care medicine as well.

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In vitro evaluation of aerosol delivery by an ultrasonic nebulizer during mechanical ventilation with an endotracheal tube and a double lumen tube

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Background and Goal of Study: Administration of aerosol medication through a bypass system while mechanical ventilation is performed has become established at intensive care units. Modern anaesthetic machines do not include an aerosol therapy functionality. The aim of this study was to compare the output of an ultrasonic nebulizer in two different connecting settings using a standard endotracheal tube (ET) and a double lumen tube (DLT).

Materials and Methods: In set-up A, an ultrasonic nebulizer was connected directly to the endotracheal tube. In set-up B, the nebulizer was placed in line in the ventilation circuit in order to direct only the inhalation flow through the nebulizer device and to bypass the exhalation flow. A standard endotracheal tube (ET) and a double-lumen tube (DLT) with two different ventilatory protocolls were examined. 5 ml of a Tc-99m 0.9%-NaCl solution were filled into the nebulizer. After nebulization, the deposits accumulated in all parts of the system were measured using a gamma scintillation counter.

Results and Discussions: Set-up A, ventilated in volume controlled mode (VCV) with ET : Delivered dose (1.61 ± 0.41 ml), nebulization time 10.13 ± 1.71 min. Set-up A, Bi level ventilation, use of a DLT : Delivered dose (1.33 ± 0.88 ml), nebulization time 13.27 ± 2.58 min.

Set-up B, ventilated in volume controlled mode with ET : Delivered dose (1.82 ± 0.12 ml), nebulization time (27.1 ± 4.5 min). Set-up B, Bi level ventilation, use of a DLT : Delivered dose (1.3 ± 0.17), nebulization time (25.6 ± 4.0 min).

In set-up B, output was not significantly higher ($p < 0.05$), but nebulization time was significantly longer ($p < 0.05$) when compared to set up A.

Conclusion(s): In set-ups where the nebulizer is connected directly to an ET or DLT, a fairly acceptable level of total aerosol output within a short nebulization time was observed.

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Comparative measurements of cough pressure in different anatomical locations at the thorax and abdomen. Preliminary results

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Background and Goal of Study: Cough is a physiological mechanism which can be weakened in the postoperative period because of surgery,