

Influence of the Impedance Threshold Valve (ITV) on Ventilation with Different Airway Devices

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Background and Goal of Study: Use of an impedance threshold valve (ITV) improves cerebral and myocardial perfusion by more than 80% during cardiopulmonary resuscitation by preventing air from passively entering the thorax and therefore increasing venous return to the heart (1). The effect on airway resistance has not been addressed so far. An ITV (ResQPOD) is tested in different airway devices provided frequently for emergency airway management in physician-staffed ambulance systems (2).

Materials and Methods: In a bench model consisting of a Ambu Megacode Station connected to a PC (Megacode software 2.23), standardized ventilation (IPPV, respiratory rate 12/min, tidal volume 750 ml) was performed with a Draeger Oxylog 3000 (Draeger medical). Tidal volumes and peak airway pressures were measured. 3-minute cycles (10 per device) were performed with facemask, tracheal tube (7.5), Combitube (37 Fr., oesophageal position), LMA-Classic (#4) and Laryngeal Tube (#4). Ventilation cycles were repeated with the ITV (total 50 cycles without, 50 cycles with ITV). Cuff pressures were adjusted to 80 cm H₂O were applicable. For statistical analysis, the t-test was used.

Results and Discussions: Tidal volumes (mean±SD) and peak airway pressures for the airway devices without/ with ITV were 588±22/579±17 ml and 13.4/14.9* cmH₂O for facemask, 730±7/690*±3 and 15.8/16.0 cmH₂O for tracheal tube, 733±6/707*±3 ml and 16.7/16.8 cmH₂O for Combitube, 540±12/530±12 ml and 12.8/13.6* cmH₂O for LMA-Classic and 713±6/691*±3 ml and 15.6/16.1* for Laryngeal Tube (* = p<0.01 compared to ventilation without ITV). Tidal volume with ITV decreased by 1.5% for facemask, 5.5% for tracheal tube, 3.5% for Combitube, 1.9% for LMA-Classic and 3.1% for Laryngeal Tube.

Conclusion(s): While the ITV has significant influence on ventilation with several of the airway devices tested, the changes in tidal volume are of little clinical relevance. The small adverse effect on ventilation is by far outweighed by the ITV's positive effect on cardiac output.

References:

- (1) Lurie KG, Crit Care Med, 2002;30(Suppl.):S162-165
- (2) Genzwuerker HV, Anaesthesist 2002;51:367-373

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