

Assist control ventilation effect on pupillary constriction velocities; A pilot observational study

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Background: Patients requiring assist control ventilation can in many occasions be ventilated with pressure control (PC) or volume control (VC) modes, according to the choice of the attending physician. Vagal nerve transfers information from the lung to the central nervous system nuclei, resulting in the regulation of sympathetic output, i.e. the locus coeruleus [1]. It is not known whether the ventilation mode can exert any effect on the sympathetic nervous system.

Aim: To investigate if different modes of assist control ventilation, VC and PC ventilation exert different effects on the autonomic nervous system, by examining the ventilation mode effect on the pupillary light reflex (PLR).

Methods: Observational study of mechanically ventilated patients on moderate sedation (RASS= -3) with propofol, remifentanil or dexmedetomidine, who are ventilated on PC or VC ventilation. Modes of ventilation were switched according to the attending physician's plan, aiming at defining the mode most suitable for each patient. Observed parameters included mean arterial pressure, oxygen saturation, heart rate, minute ventilation, respiratory rate, tidal volume, mean and maximum pupillary constriction velocity. Parameters obtained at least 15 minutes under stable ventilatory settings were included in the analysis. The NPI 200 pupillometer was used for pupillometry assessment. Sedative infusion rates and ambient light conditions were stable during the examination period. Nonparametric statistics were applied. Pupillometry values during PC and VC ventilation were compared with Wilcoxon Signed Rank Test.

Results: Fifteen patients, 8 women and 7 men, were included in the analysis, consecutively ventilated with PC or VC mode or vice versa. There were no significant differences in the heart rate, oxygen saturation, mean blood pressure, minute ventilation and tidal volume of the patients during the different ventilation modes. Both the mean ($p= 0.002$) and maximum ($p< 0.001$) constriction velocities were higher during volume control (0.93 mm/s and 1.33 mm/s, respectively) compared to those during pressure control ventilation (0.82 mm/s and 1.21 mm/s, respectively).

Conclusions: Since the sympathetic nervous system tends to dilate the pupil, it is likely that the PC mode may cause increased sympathetic activation compared to VC, even when patients are lightly sedated. This finding needs to be confirmed with randomized trial designs.

References: Bassi TG, Rohrs EC, Fernandez KC, Ornowska M, Nicholas M, Gani M, Evans D, Reynolds SC. Transvenous Diaphragm Neurostimulation Mitigates Ventilation-associated Brain Injury. *Am J Respir Crit Care Med.* 2021 Dec 15;204(12):1391-1402. doi: 10.1164/rccm.202101-0076OC. PMID: 34491883; PMCID: PMC8865722.