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## MEASUREMENT OF EXPIRATORY VALVE RESISTANCE AND ITS EFFECT ON T LOW USING APRV MODE AND A LOW-COMPLIANCE LUNG MODEL.

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**Introduction:** Every ventilator has a unique expiratory valve with a different expiratory resistance. This inherent resistance affects expiratory flow in patients being ventilated with airway pressure release ventilation (APRV) when using a common practice of limiting the release phase to 50% of peak expiratory flowrate (PEFR). In this study, we sought to compare the relationship between expiratory valve resistance in four newer generation ventilators and the T low needed to terminate expiration to 50% of PEFR in a low compliance lung model.

**Methods:** The Drager XL, PB 840, Maquet Servoi, and Viasys Avea ventilators were used in our study. To test the resistance of each expiratory valve, a Certifierï¿½ FA Plus pneumotachometer (TSI Incorporated, Shoreview, MN) was placed at the front of the expiratory valve and at the gas exhaust port. A Thorpe flowmeter was then connected to the proximal end of the pneumotachometer via small bore tubing. Flow was increased on the flowmeter until the desired flow was obtained. The pressure drop from the expiratory valve to the exhaust port was then measured and divided by the set flow rate to obtain resistance. Three different flow rates were used to determine resistance: 0.5 L/s, 0.667 L/s, and 0.833 L/s. After resistance was determined, each ventilator was then taken through its performance check using the same circuit. After the performance check was completed, every ventilator was placed on a Michigan 5601i test lung (Michigan Instruments, Grand Rapids, MI), which was calibrated for a static compliance of 20 ml/cmH2O and resistance of 5 cmH2O/L/sec. The ventilators were placed in APRV mode or their equivalent with T high of 5 s, P high of 25 cmH2O, P low of 0 cmH2O, and T low adjusted to achieve 50% of PEFR. T low was then recorded.

**Results:** The Viasys Avea had the highest mean expiratory valve resistance (5.4 cmH2O/L/s) followed by the 840 (4.23) and the Drager XL (3.59). The lowest mean expiratory valve resistance was measured at 3.22 cmH2O/L/s in the Servoi. When we observed the T low needed to achieve 50% of PEFR in our lung model, the results were as follows: Avea = 0.7 s,

840 = 0.63 s, Drager XL = 0.6 s, and Servoi = 0.4 s.

**Conclusion:** There is a direct relationship between the resistance produced by a ventilator's expiratory valve and the T low needed to terminate expiration to 50% of PEFR. The lower the expiratory valve resistance, the less the T low required to achieve this goal when using APRV.