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Leak Compensation Comparisons in Mechanical Ventilation

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Background: A bench test was performed comparing leak compensation on the Maquet Servo i, Drager Evita 4, and the Viasys Avea. Using the same ventilator circuit for each ventilator a leak was created by opening the saline port on a Ballard suction catheter. Using the same ventilator settings the peak pressure, minute volume, measured rate, and exhaled tidal volume were measured. The intrinsic peep was measured by a Hans Rudolph Series 1101 breathing simulator. This study will confirm which ventilator tolerates a leak with a minimal change in parameters.

Method: A piece of large bore tubing was connected to a Hans Rudolph Series 1101 breathing simulator. Then a size 7.0 mm endotracheal tube was placed in the tubing and the cuff inflated to make sure there was no leak. Each ventilator was then attached to the endotracheal tube (ETT) using the same ventilator circuit. A Ballard closed system catheter was also placed in line with the circuit at the ETT. The breathing simulator was set for a resistance of 7 cmH₂O/l/sec, compliance of 40 ml/cmH₂O, and a set breath rate of 12. All ventilator parameters were set the same (VT 500ml, f 12, PEEP 5 cmH₂O, I.T. 1.2 seconds). The Viasys Avea and Maquet Servo I were placed in the pressure regulated volume control mode of ventilation while the Drager E4 was placed in CMV with auto-flow. The sensitivity on all ventilators was set for flow trigger. PIP, V_E, measured f, exhaled V_T and intrinsic PEEP was then noted without a leak. A leak was created by uncapping the saline port on the Ballard suction catheter and then all parameters were then noted with the leak.

Results:

Drager Evita 4	Without Leak	With Leak
Peak Pressure	18 cmH ₂ O	18 cmH ₂ O
Minute Volume	5.7 L/min	5.2 L/min
Measured Rate	12 bpm	12 bpm