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## PRESSURE SUPPORT VS AUTOMATIC TUBING COMPENSATION - PRESSURES SEEN AT THE END OF ENDOTRACHEAL TUBE IN BI-VENT/APRV MODE

Carrianne Mankey RRT, David Frana RRT, Corey Paulsen RRT, Princewill Ibe RRT, Aaron Light BSRT RRT; Ozarks Technical Community College, Springfield, MO

**Background:** It has been said that adding pressure support (PS) on top of P high in Bi-Vent (APRV) mode is not an appropriate form of mechanical ventilation. Some of the reasoning behind this thinking is the fact that the patient would be receiving higher pressures than the P high which increases their chances of developing barotrauma. However, it is accepted to add automatic tubing compensation (ATC) to the same mode. We are testing to see if the patient in fact receives any of the added pressure of PS or ATC in APRV (Bi-Vent). Our hypothesis is that at low levels of PS the lungs will not receive a higher positive carinal pressure than the set P high.

**Methods:** The experiment was designed to test the difference in pressures measured at the end of the endotracheal tube (ETT) when ATC vs. extra PS is added to P high in APRV. We performed the experiment in Bi-Vent mode on the Maquet Servo i and APRV on the Drager Evita 4. Three commonly used ETT sizes were used. The tested tube sizes were 7.0 mm, 7.5 mm, and 8.0 mm. The trial was set up with the ETT inserted into a six inch section of large bore tubing with the cuff inflated to prevent leaks. This tubing was then connected to a 5600i Michigan test lung. A pressure manometer was placed just below the bottom of the ETT to measure simulated carinal pressures. The ventilators were set up in Bi-Vent/APRV mode with a P high of 20 cmH2O, T high 5 sec, and a T low to achieve 50% of PEFR. The Michigan test lung was then set to trigger 15 breaths per minute, and the amplitude on the Michigan was adjusted to achieve a $V_T$ of 250-300 ml on spontaneous breaths.

**Results:**

Maquet Servo I (Bi-Vent)

| | |
|---|---|
| 7.0 ETT P high 20 cmH20 | PS 8 = 20 cmH2O reading at the bottom of the ETT (no change)<br>PS 9 = 23 cmH2O reading at the bottom of the ETT (increase of 3)<br>PS 10 = 24 cmH2O reading at the bottom of the ETT (increase of 4) |
| 7.5 ETT P high 20 cmH20 | PS 7 = 20 cmH2O (no change)<br>PS 8 = 21 cmH2O (increase of 1)<br>PS 10 =24 cmH2O (increase of 4)<br>PS 12 = 25 cmH2O (increase of 5) |
| 8.0 ETT P high 20 cmH20, | PS 6 = 20 cmH2O (no change)<br>PS 7 = 23 cmH2O (increase of 3)<br>PS 8 = 24 cmH2O (increase of 4)<br>PS 10 = 26 cmH2O (increase 6) |
| Drager Evita 4, APRV with ATC | 7.0 ETT pHigh 20 with ATC = 20cmH2O (no change at bottom of ETT)<br>7.5 ETT pHigh 20 with ATC = 20 cmH2O (no change)<br>8.0 ETT pHigh 20 with ATC = 20 cmH2O (no change) |

**Conclusion:** Based on the data collected we feel that if a ventilator does not have ATC , one can add low levels of PS on top of P high and have little to no effect on carinal pressures. The statement of PS increasing the pressures of ventilation is true in that we did see changes in the PIP readings on the vent, but this rise in PIP was also seen with ATC. The interesting part is that these peak inspiratory pressures were not transmitted down the ETT, just as we hypothesized. PS levels of 6, 7 and 8 cmH20 for their respective ETT sizes showed no changes in carinal pressures and the other levels of PS showed minimal rises in pressure. What was not tested in this bench study is the effect of variable inspiratory flowrate on carinal pressure. More study is indicated in this area.

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