Background:

The purpose of this study was to determine how 6-foot, 12-foot and 25-foot adult circuit lengths affect the delivered volume and peak pressure during volume-targeted, assist-control, using the LTV 1000. The LTV 1000 is a ventilator commonly used during transport, or for ventilator-dependent patients in home care to increase mobility, allowing the patient to move around and function. The use of 12 or 25 foot circuits could be beneficial for transport and increasing patient mobility. Prior to this study, little research was conducted to determine if using longer circuits affected pressures and volumes, making it safe for home care to increase mobility, allowing the patient to move around and function.

Methodology:

Research was conducted in the Lung Mechanics Laboratory in the College of Health Sciences at Boise State University using the Hans Rudolph Breathing Simulator (HR1101). The LTV 1000 was connected to the HR1101 and calibrated by an auto-calibration feature within the HR1101. A minimum of five breaths was recorded with each circuit length using all combinations of Compliance (C), Resistance (R) and Rate. Tidal volume was set at 400 mL, 600 mL and 800 mL; Rate 5/minute; PEEP 0 cm H₂O; Inspiratory time 1 second; O₂/L/sec, then waited for stabilization. Next, resistance was increased 5 cm H₂O; waited for stabilization, then increased resistance to 10 cm H₂O. A minimum of five breaths was recorded at each setting of resistance. Increasing a patient’s mobility by ventilating with a longer circuit can be very beneficial in certain circumstances. During volume-targeted, assist-control ventilation, the delivered volume remained constant, but peak inspiratory pressure increased as resistance increased; however, the increased peak inspiratory pressure was considerably higher while volumes were considerably lower.

Results:

Data from each breath was closely evaluated and any questionable data points were eliminated. The values were then compared using an Excel spreadsheet where it was analyzed. Data from each breath was closely evaluated and any questionable data points were eliminated. The values were then compared using an Excel spreadsheet where it was analyzed. The data was transferred directly into an Excel spreadsheet where it was analyzed. Data from each breath was closely evaluated and any questionable data points were eliminated. The values were then compared using an Excel spreadsheet where it was analyzed. Data from each breath was closely evaluated and any questionable data points were eliminated. The values were then compared using an Excel spreadsheet where it was analyzed. Data from each breath was closely evaluated and any questionable data points were eliminated. The values were then compared using an Excel spreadsheet where it was analyzed.

Discussion/Conclusion:

The Effect of Circuit Length and Resistance on Delivered Volume and Peak Inspiratory Pressure using the LTV 1000:

Volume 300 mL, PEEP 0 cm H₂O: Compliance 20 ml/cm H₂O

Volume 400 mL, PEEP 0 cm H₂O: Compliance 20 ml/cm H₂O

Volume 500 mL, PEEP 0 cm H₂O: Compliance 20 ml/cm H₂O

Volume 600 mL, PEEP 0 cm H₂O: Compliance 20 ml/cm H₂O

Please see Graphs 1 – 3 and the table for the results.