Comparison of Mechanical Insufflation-Exsufflation Using a Stand Alone Device and Integrated into a Ventilator

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INTRODUCTION
Mechanical insufflation-exsufflation (MI-E) enhances secretion clearance in patients with neuromuscular disease. MI-E simulates a cough guided by the cough peak flow (CPF). Since inception, MI-E has required a stand-alone device. We compared a standard MI-E device (T-70, Philips, PA) to MI-E integrated into a ventilator (VOCSN, Ventec Life Systems, WA) in a bench model.

METHODS
Each device was connected to an ISO rigid lung model with CL set at 50 or 80 mL/cm H2O and Raw of 10 cm H2O/L/s via standard circuits (passive and active). Devices were set at 3 different inspiratory/expiratory pressure settings (+30/-30, +50/+50, and +30/-50 cm H2O) and 2 inspiratory rise times (fast and slow). Insp and Exp times were fixed at 3.0 secs with no pause time. We measured airway pressures, volumes and flows using a Citrex H5 Analyzer (IMT Analytics, SZ) at 500 Hz and calculated peak PIF and PEF, the duration of time PEF was > 90% (T90%), IP, EP and delivered VT. Median and ranges were calculated and compared between the T70 and the VOCSN with a passive (Vp) and active (Va) circuit. Artificial mucus (1 mL) was placed in an 8 mm ID clear tube over a 2 cm distance. Photographs were taken before and after 3 cough cycles and video was recorded for each of 3 trials using a 12 mp camera. Photos were imported to a PC and the distance mucus moved antegrade and retrograde was determined.

Net mucus movement was compared using Wilcoxon rank sum test, a p < 0.05 was significant. Airway pressure and flows were expressed as median (range) and compared using Kruskal-Wallis test.

RESULTS
Table 1 displays the data for +30/-30 cm H2O at the slow and fast rise time at a C0 of 50 mL/cm H2O. VOCSN resulted in statistically significant (p=0.049) increases in mucus movement. Factors impacting mucus movement included PIF, PIF-PEF, and Vc. Changes were NSS. Absolute PIF and PEF were higher with T-70 but were not statistically different (p=0.121). T90% was longer with VOCSN, but not statistically significant (p=0.121).

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