Physiologic Evidence for High-Frequency Chest Wall Oscillation and Positive Expiratory Pressure Breathing in Hospitalized Subjects With Cystic Fibrosis

DARBEE JC, KANG JA, OHTAKE PI. PHYSIOLOGIC EVIDENCE FOR HIGH-FREQUENCY CHEST OSCILLATION AND POSITIVE EXPIRATORY PRESSURE BREATHING IN HOSPITALIZED SUBJECTS WITH CYSTIC FIBROSIS. PHYSICAL THERAPY. 2005; 85: 1278-1289.

Background
In patients with Cystic Fibrosis (CF), infected airway secretions cause peripheral airways to lose their stability and collapse trapping air and mucus. This will cause lung function to deteriorate, abnormalities in ventilation distribution to worsen, ventilation-perfusion mismatching, hypoxemia, pulmonary hypertension, and eventually respiratory failure. In people with CF, the effective loosening and removal of airway mucus is crucial to enhancing life expectancy and decrease morbidity. Goals of airway clearance techniques (ACTs) are to decrease airway obstruction and airflow limitation and to improve ventilation distribution through the mobilization and removal of airway mucus.

Purpose
Thus far, there have been few studies on the effects of ACTs on ventilation distribution or gas mixing. Due to the limited information available regarding two specific ACTs, high-frequency chest wall oscillation (HFCWO) and positive expiratory pressure (PEP), it is unclear whether one of these techniques is more efficacious than the other. This experiment is to compare the physiologic effects of HFCWO and PEP on ventilation distribution and gas mixing for people with CF.

Methods
15 subjects agreed to participate in the study. They were eligible to participate if they were being hospitalized for treatment of an acute exacerbation of their CF-related chronic obstrusive lung disease, were able to perform lung function testing according to standard guidelines, were at least 7 years of age, and were regarded as medically stable by their primary CF physician.

Single-breath inert gas tests and spirometry were performed both immediately and immediately after HFCWO or PEP breathing treatments to assess ventilation distribution, gas mixing, and lung function on two separate successive days within 48 hours of hospital arrival and discharge. Patients were randomly assigned into one of two groups for treatment order. Each group had either HFCWO or PEP on day 1 of admission and the other on day 2. Upon discharge, the groups were to perform the ACTs in the opposite order.

Discussion
Both HFCWO and PEP breathing were similarly efficacious in improving pulmonary function, ventilation distribution, and gas mixing for subjects who had CF and who were experiencing an acute exacerbation of their pulmonary disease. HFCWO was associated with a small decrease in SpO2 while PEP was associated with a small increase.

Clinical Significance
While there is no obvious better choice of ACT is this study, there was one result that may sway a health care provider towards one over the other. If a patient has a low level of SpO2 before therapy, HFCWO may not be the best choice for them because it was shown to further decrease oxygen levels, which could cause hypoxemia.

Conclusion
Both HFCWO and PEP breathing interventions are associated with improvements in ventilation distribution and gas mixing. Either can be recommended for people with stable CF-related lung disease. Patient preference should be considered in the prescription of a specific ACT.

Article #1 and Evidence
This study concentrated on FEV1, PFC, SpO2, and sputum expectoration between HFCWO and PEP. There were no statistically significant differences for any values other than SpO2. In HFCWO, SpO2 was shown to increase while PEP showed a decrease. This could be due to the time that the measures were taken.


Article #2 and Evidence
This study concentrated on sputum, FEV1, PFC, SpO2, and patient preference between HFCWO and other ACTs (PEP not included). There were no statistically significant results between the ACTs. SpO2 for HFCWO was shown to increase during treatment but decrease after treatment.


Summary
In patients with CF having a related acute pulmonary exacerbation, either HFCWO or PEP breathing are appropriate ACTs. The decision of which technique to use should be based upon the patient’s response to either change or drop in SpO2 and their preference (ease of use or comfort).

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