HFCWO and The Vest® Airway Clearance System Studies:

Acute Care/Post-Surgical Patients

Article Citation	Type of Study	Number (n) & Type of Subjects	Protocol	Outcome
Allan JS, Garrity JM, Donahue, DM. The Utility of High Frequency Chest Wall Oscillation Therapy in the Post-Operative Management of Thoracic Surgical Patients. *Respir Care* 2009;54:340 –343.	Prospective	25 patients undergoing a wide variety of elective thoracic surgical procedures	Consecutive patients undergoing elective thoracic surgical procedures received HFCWO as part of their routine post-operative care to facilitate the clearance of postoperative pulmonary secretions. • HFCWO was applied using The Vest® Airway Clearance System. – Frequency: 12Hz Duration:10 minutes. • Routine hemodynamic and pulse oximetric data collected before, during, and after treatment. • Qualitative data regarding patient tolerance and preference (as compared to CPT) also collected.	• No major adverse events were encountered during or subsequent to HFCWO. • Hemodynamic and pulse oximetric data remained stable throughout the treatment period. • Eighty-four percent of patients reported little or no discomfort during therapy. • HFCWO was preferred to conventional chest physiotherapy by a 2:1 margin.
Anderson C, Palmer C, Ney A, Becker B, Schaffel S, Quickel R. (2008, October 17). Evaluation of the safety of High-Frequency Chest Wall Oscillation (HFCWO) therapy in blunt thoracic trauma patients. *Journal of Trauma Management & Outcomes*, 2(8), Retrieved from http://www.traumamanagement.org/content/2/1/8 doi: 10.1186/1752-2897-2-8	Prospective Observational	25 blunt or penetrating thoracic trauma patients enrolled	Consecutive patients (18 years or older) with blunt or penetrating chest wall injury that consented to the study were enrolled. Subjects included patients with rib fractures; pulmonary contusion; sternal, clavicular or scapular fractures; stable spinal cord injury patients (T5 and above), hemothorax and/or pneumothorax requiring chest tubes. • Physiological parameters were measured before, during, and after treatment. • Ventilator parameters were documented for patients requiring mechanical ventilation. • Follow-up was done on all patients after 30 days.	• Patients in this study tolerated the therapy well and typically did not require additional medication for pain management, despite the severity of their injuries although some treatments were skipped due to pain or nausea. • No lines, chest tubes, drains or epidural/ventriculostomy catheters dislodged. • 4 patients withdrew prior to completing the study. • No patients were withdrawn as a result of adverse effect of therapy.
Arens R, Gozal D, Omlin K, Vega J, Boyd K, Keens T, Woo M. Comparison of high-frequency chest compression and conventional chest physiotherapy in hospitalized patients with cystic fibrosis. Am J *Respir and Crit Care Med* 1994; 150: 1154-1157.	Randomized Controlled	50 cystic fibrosis patients	Patients hospitalized for acute pulmonary exacerbations were treated with aerosolized bronchodilators and randomized to receive either: • HFCWO (n=25) 3x/day for 4-6 min at each of 6 frequencies; (mean age 22.9 + 2.0). • CPT (n=25) 3x/day with percussion and postural drainage; (mean age 18.0 + 1.3).	Both HFCWO and CPT patients showed: • Significant improvements in pulmonary function and clinical status; no statistical difference between groups. • Mean percentage change in VC, FEV, FEF 35-75, RV, RV/TLC, and SpO_2 improved w/o differences between groups. • 1 hr sputum wet weight significantly increased by HFCWO ($p<0.035$) and dry weight increased but not significantly. • 24 hr sputum wet and dry weight similar for HFCWO and CPT groups.
Braxton M. The Vest® Airway Clearance System: a retrospective chart review of 67 post-cardiac surgical patients (unpublished clinical data).	Retrospective chart review	67 of 130 consecutive post-cardiac surgical patients	Patients identified by retrospective chart review received post-operative therapy with The Vest® Airway Clearance System. • Subjects had procedures including aortic valve replacement, mitral valve repair, bilateral mammary artery grafting, gastroepiglotic graft to inferior wall and tricuspid valve annuloplasty. • Comorbidities included asthma, bronchiectasis, rheumatoid arthritis and emphysema. • All subjects were extubated at initiation of HFCWO therapy; all had external pacer wires in place; 16% had chest tubes, and 3% had Swan-Ganz catheters.	Outcomes data showed: • No incidence of complications from sternal incision • No chest tube/JP tube related complications • No catheter-related problems • No pacer wire problems • Other complications (wound infection, stroke, etc.) = 1.4% • Patients generally tolerate • Safe addition to the pulmonary care program of cardiac/thoracic patients
Brierley S, Adams C, Suelter J, Grooch T, Becker B. Safety and tolerance of High Frequency Chest Wall Oscillation (HFCWO) in hospitalized critical care patients. *Respir Care* 2003; 48 (11): 1112.	Prospective Observational	73 critical care (mostly post-surgical) patients	Acute care patients received The Vest® Airway Clearance System Therapy. Invasive or sensitive devices used concurrently, included: Sternal Incision/sternal wires (48); Chest tubes (24); External pacer wires (30); Swan Ganz catheters (27); Penrose drains (23); Central venous pressure lines (21); Implanted pacemakers (11); CPAP or BiLevel (5); Mechanical ventilation (1); Implanted cardiac defibrillator (1); • A total of 179 therapy days were evaluated.	The Vest® Airway Clearance System is a safe and well-tolerated therapy for most post-surgical and critical care patients. • No significant adverse events occurred. • Only twelve (16.4%) patients discontinued, because of inability to tolerate. • Subjective tolerance ratings among continuing users for all therapy days. (1 = poorly tolerated, 5 = well tolerated) were: Mean + SD = 4.3 + .94; Median = 5.0

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Davis M, Harrington T, Stein D, Shanholtz C. High-Frequency Chest Wall Oscillation increases secretion clearance and chest radiograph in a patient with traumatic brain injury, a case study. *Respir Care* 2008; 53 (11): 1553.	Case Report	1 traumatic brain injury (TBI) patient (with multiple fractures)	Report of a single case involving a TBI patient with complicated hospital course including abdominal compartment syndrome, ARDS, and MRSA pneumonia. Elevated intracranial pressure (ICP) and low cerebral perfusion pressure necessitated placement on erect tilt table. HFCWO was initiated hospital day four every two hours - progressed to twenty minute intervals followed by twenty minute breaks for four consecutive days.	• Respiratory therapists subjectively recorded notable increases in secretion volume cleared during and after HFCWO. • Radiographic improvement seen during the four days of frequent HFCWO. • Patient weaned from Mechanical ventilation within four days of initiation of HFCWO.
Ganz SS, Levi DM, Nishida S, et al. Improving pulmonary function and lung recovery for transplantation using The Link™ during organ donor management. Poster presentation. Association of Organ Procurement Organizations (AOPO), Chicago IL June 14-18, 2004.	Prospective, Historical Controls	61 eligible lung donors	Organ donor patients treated according to protocol (cycle of 1 hr. HFCWO then therapy off for 30 min.) with The Link™ System. The Link™ System is a slight modification of The Vest® System Model 103, designed for continuous cycling to simplify use in organ donors. HFCWO provided per protocol from brain death declaration until transfer to OR for organ recovery. Donor outcome parameters compared with 79 historical controls. Monitored data included ABCas on 100% FiO_2, P/F Ratio, CxR grams staity and organ recovery rates.	HFCWO-treated donors demonstrated: • 87% improvement in lung procurement ($p = 0.015$) [23.8% w/ The Link™; 12.7% controls]. • Increase in maintenance of P/F ratios > 300 ($p = 0.04$) • Trend toward improvement in chest x-ray densities and reduction in white blood cells (WBCs) on gram stain.
Kluft J, Beker L, Castagnino M, Gaiser J, Chaney H, Fink R. A comparison of bronchial drainage treatments in cystic fibrosis. *Pediatr Pulmonol* 1996; 22: 271-274.	Prospective, Randomized, Crossover	29 cystic fibrosis patients	Patients hospitalized with acute pulmonary exacerbations were randomly allocated to treatment with HFCWO and CPT for 2 days each over a 4-day period. Sputum amount, determined by both wet and dry weight, during and after treatment used as a clinical index of mucus clearance. • HFCWO 30 minutes, 3x/day • CPT 10-15 minutes, 3x/day	Treatment with HFCWO yielded significantly more sputum (both wet [p=0.001] and dry [p=0.01]) than CPT.
Rhodes DJ, Lemons NV, Coupland DJ, et al. Simultaneous Application of Vibrating Vest and Cough Assist Device Improve Respiratory Function in Stroke Patients. Presented at the 28th International Stroke Conference, Phoenix, AZ. 2003. *Stroke* 2003; 34 (1): 314-315.	Prospective	10 acute stroke patients	Patients were treated with either a combination of The Vest® Airway Clearance System Therapy and a mechanical cough-assist device or conventional respiratory care for at least 3 days. • All patients received nebulized bronchodilators every 4 hours. • Pulmonary function measures done before and after each treatment using bedside spirometry.	• The Vest® Airway Clearance System/cough assist patients showed significant improvement in: - Forced vital capacity (FVC) [$P = 0.0001$] - Minute ventilation (Ve) [$P = 0.02$] • The Vest® Airway Clearance System/cough assist patients showed a positive trend in SpO_2; [$P = 0.08$]. • Conventional care patients showed NO significant improvements in any of the parameters measured.
Whitman J, Van Beusekom R, Olson S, Worm M, Indihar F. Preliminary evaluation of high-frequency chest compression for secretion clearance in mechanically ventilated patients. *Respir Care* 1993; 38(10): 1081-1087.	Randomized Crossover	9 mechanically ventilated patients	Patients mechanically ventilated (MV) for more than 30 days were randomly assigned to treatment with HFCWO or CPT for 2 days each over a 4-day period. • HFCWO at either 3 or 4x/day@ 8 and 16 Hz for 5 minutes each, 10 minutes total. • CPT at either 3 or 4x/day in 5 lung regions for 2 minutes each, 10 minutes total; 15° Trendelenberg for lower lobe drainage.	Using SpO_2, heart rate, blood pressure and patient comfort as outcomes: • CPT and HFCWO appear equally safe • CPT and HFCWO appear equally effective • 80% of therapists judged HFCWO more time-efficient

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