Chest Physiotherapy: The Gold Standard?

Jane M. Braverman, Ph.D.

Employed by Hill-Rom

Author Profile

Dr. Jane Braverman has experience in laboratory, academic, and technological medicine. She has worked as a medical technologist in basic research at the University of Minnesota and in clinical laboratory medicine at Twin Cities hospitals. After earning her Ph.D., she served as assistant professor in the Department of the History of Medicine at the University of Minnesota. Dr. Braverman, as research analyst/writer for Hill-Rom, has contributed to a variety of research endeavors and developed white papers, case studies, and other supporting materials.

CHEST PHYSIOTHERAPY: THE GOLD STANDARD?

The therapeutic necessity of routine airway clearance in the treatment of cystic fibrosis is well established.[1,2,3,4,5] Traditionally, the removal of mucus from the lungs is accomplished using a technique called chest physiotherapy (CPT). Chest physiotherapy is an airway clearance technique that combines manual percussion of the chest wall by a caregiver, strategic positioning of the patient for mucus drainage, and cough and breathing techniques. The technique is sometimes called percussion and postural drainage (P&PD). CPT is based on the theory that percussion to various areas of the chest and back transmits shock waves through the chest wall, thus loosening secretions in the airways. Among the array of modalities used to administer airway clearance, CPT has for decades enjoyed status as the "gold standard."[6,7,8,9,10] Until the introduction in recent decades of alternative methods, such a reputation was well-deserved. A plethora of studies have demonstrated indisputably the great value of CPT in mitigating pulmonary exacerbations among CF patients.[11] In clinical studies performed under strict supervision and ideal conditions, CPT is highly effective in mobilizing mucus and facilitating airway clearance.

In actual practice, the administration of CPT is fraught with intrinsic and extrinsic difficulties.[12,13,14] Under the best of circumstances, CPT is a time-consuming, labor-intensive treatment requiring significant skill and strength on the part of the therapist and the mental and physical cooperation of the patient. Typical treatment sessions last 20-30 minutes and may be required up to three times daily. During postural drainage, the patient is placed in various positions on a slant board to facilitate gravitational movement and expectoration of mucus. Such manipulations are difficult or impossible to achieve in patients who are medically complex, anatomically deformed, immobile, physically large, or dependent on ventilators or other pieces of cumbersome medical equipment. Postural drainage cannot be accomplished effectively in patients who are mentally impaired, uncooperative, or severely spastic. Many individuals may be unable to tolerate the transient hypoxemia associated with postural drainage, to coordinate expiration sufficiently, or to generate the expiratory pressures required for effective CPT.[15] Moreover, recent research suggests that, because refluxed gastric contents are recognized as a significant cofactor in pulmonary deterioration, the postural drainage component of CPT is contraindicated for the high proportion of CF patients with symptoms of gastroesophageal reflux.[16,17,18]

Although CPT advocates recognize inherent disadvantages--physical and technical difficulties, expense, and time requirements--few question its clinical efficacy. Among many pulmonologists, the central role of CPT in airway clearance therapy is a "given". Once a treatment protocol or therapeutic modality has achieved general approval in the medical community, there is little incentive to subject it to critical re-evaluation. However, as physicians become increasingly aware of the crucial role of airway clearance therapy in the preservation and maintenance of health in vulnerable individuals, awareness of the weaknesses of CPT is also growing. There is an urgent need to reappraise the status of CPT as the modality of first choice.

Recently, several investigators have scrutinized the airway clearance literature and called for a re-examination of the research supporting the reputation of CPT as the therapeutic gold standard.[19,20,21,22] Although an important meta-analysis of studies concerning the efficacy of CPT in CF has confirmed its intrinsic value,[23] the quality of many of those CPT studies has been called into question. The lack of a standard definition of CPT,[24] its often casual or indiscriminate use,[25] its extremely poor rates of compliance,[26] and the crucial importance of individual technique in administering the method suggest that acceptable levels of efficacy are achieved irregularly.

In a letter responding to a review article comparing various clinical studies of CPT,[27] the difficulties inherent in judging such research are enumerated:[28]

> **"**One of the difficulties of comparing the numerous studies on CPT is that the techniques used and termed by their users as CPT are different. As an example, reported treatment times range from 2-3 minutes, [2] to 7-20 minutes [3], to a restricted

predetermined duration of 10-15 minutes [4] or, as in our practice [5], CPT is continued provided secretions are still obtained, the patient is tolerant of the procedure and objective evidence is obtained of beneficial effect. …Our treatment times…are inclusive of positioning for postural drainage and return to the original position after CPT; positioning alone may take 10-20 minutes. Many studies of CPT do not use postural drainage [6,7], other practitioners do not use manual chest vibration or percussion [7] and some do not encourage coughing [8]. What is lacking in the literature is a definition of CPT."

In addition to inconsistent treatment regimens, the efficacy of CPT is seriously compromised by low rates of treatment adherence. Poor adherence to prescribed treatment protocols is the weak link in therapeutic regimens for virtually every medical condition. Even in uncomplicated treatments limited to taking oral medications, a review of several studies indicates that adherence rates fluctuate around 50%.[29] In cystic fibrosis (CF) and other chronic, ultimately fatal disorders, therapeutic goals are most often compromised by poor patient compliance.[30,31] In general, patients with chronic disease comply with about 50% of recommended treatments, and compliance with individual components of treatment programs varies according to their perceived unpleasantness and extent of infringement on daily activities.[32,33] Although compliance with daily CPT has been shown to modify the progression of pulmonary deterioration in patients with CF,[34] various studies indicate that, in general, CPT has the *lowest adherence rate* of any aspect of CF care.[35] In four such studies, investigators found that rates of patient adherence to prescribed CPT protocols ranged from 26-47%.[36,37,38,39] Davids and Henley (1990) and Fong et al (1988) found that 52.7 and 74%, respectively, of patients received their CPT treatments two or fewer times per week.

In light of poor rates of adherence to CPT, the results of studies of CPT conducted under medical supervision may yield measures of efficacy, such as improved pulmonary function scores, not realized during unsupervised use. This factor alone may account for unjustifiable physician preferences for prescribing CPT.

For patients who are unable to benefit fully from traditional CPT, The Vest™ airway clearance system provides an alternative therapeutic modality that delivers consistent, high-quality airway clearance. Developed initially for the treatment of cystic fibrosis, The Vest™ system is appropriate for any patients with excessive mucus production and difficulty clearing secretions.[40] Its method, high-frequency chest wall oscillation, achieves the outcomes for airway clearance therapy published by the American Association for Respiratory Care.[41] The Vest™ system does not require positioning or postural drainage; it is not technique-dependent; and it can be administered without a caregiver or with minimal caregiver supervision.

The Vest™ system has been acknowledged in Mosby's *Case Management Practices for Cystic Fibrosis*[42] and in a Continuing Medical Education resource publication developed at Duke University Medical Center and Health System[43] as an approved alternative to CPT, consistent with good medical practice and case management guidelines. Most recently, The Vest™ system has been acknowledged in the just published seventeenth edition of the Merck Manual.[44]

The Vest™ system has been well accepted by pulmonologists specializing in the care of cystic fibrosis patients, and more than 95% of the 114 certified Cystic Fibrosis Centers nationwide prescribe the device. Therapy with The Vest™ system has been prescribed for more than 30,000 patients, including both those with CF and with a broad range of primary diagnoses in which mucociliary dysfunction seriously compromises health.[45] Currently, more than 2,000 hospitals use The Vest™ system to provide in-patient airway clearance treatments. Clinical references include reports of more than 80 clinical studies performed at over 60 major institutions. Fifteen additional clinical trials are in progress.

Although few studies of The Vest™ system and treatment adherence have been completed,[46] clinicians anticipate high rates of compliance because the simplicity of the method obviates many traditional treatment disincentives. Most physicians prescribe between 10 and 40 minutes of The Vest™ system therapy per day. According to recent follow-up data obtained from usage meters located on the bottom of generator, therapy adherence during the first six months of The Vest™ system use averages 26.4 minutes per day, slightly over the mean use expectation of 25 minutes.[47]

References

[1] Coates AL. Chest physiotherapy in cystic fibrosis: spare the hand and spoil the cough? [Editorial] *J Pediatr* 1997; 131:506-508.

[2] Kirilloff LH, Owens GR, Rogers RM, Mazzocco MC. Does chest physiotherapy work? *Chest* 1985; 83(3): 436-444.

[3] Reissman JJ, Rivington-Law B, Corey M, et al. Role of conventional chest physiotherapy in cystic fibrosis. *J Pediatr* 1988; 113: 632-636.

[4] Zach MS, Oberwalder B. Chest physiotherapy–the mechanistic approach to anti-infective therapy in cystic fibrosis. *Infection* 1987; 5: 381-384.

[5] Ibid.

[6] Reisman JJ, et al, op. cite (n. 3).

[7] De Boeck C, Zinman R. Cough vs chest physiotherapy. *Am Rev Respir Dis* 1984; 129:

182-184.

[8] Rossman C, Waldes R, Sampson D, Newhouse M. Effect of chest physiotherapy on removal of mucus in patients with cystic fibrosis. *Am Rev Respir Dis* 1982; 126: 131-135.

[9] Pryor S, Webber B, Hodson M, Batten J. Evaluation of the forced expiration technique as an adjunct to postural drainage in treatment of cystic fibrosis. *Br Med J* 1979; 2:417-418.

[10] Pryor S, Webber B, Hodson M, Batten J. Evaluation of the forced expiration technique as an adjunct to postural drainage in treatment of cystic fibrosis. *Br Med J* 1979; 2:417-418.

[11] See Appendix I.

[12] Langenderfer B. Alternatives to percussion and postural drainage. *J Cardiopulm Rehabil* 1998; 18: 283-289.

[13] Eid N, Buchheit J, Neuling M, Phelps H. Chest physiotherapy in review. *Respir Care* 1991; 36 (4): 270-282.

[14] Prasad SA, Main E. Finding evidence to support airway clearance techniques in cystic fibrosis. *Disabil Rehab* 1998; 20 (6/7): 235-246.

[15] "Contraindications to chest physical therapy include situations in which proper positioning cannot be safely accomplished, in which injuries would preclude appropriate percussion or vibratory maneuvers, or in which pre-existing disease processes could be exacerbated during procedures. Specifically, contraindications to the Trendelenberg position include increase cranial pressure, recent neurosurgical procedures, unclipped cerebral artery aneurysms, uncontrolled hypertension, pulmonary edema associated with congestive heart failure, abdominal distention, increased risk for gastroesophageal reflux and/or aspiration (i.e. esophageal surgery, altered airway protective reflexes or *decreased mental status*), ongoing epidural narcotic/anesthetic infusion and recent eye surgery. Reverse Trendelenberg is contraindicated in the presence of hypotension or other hemodynamic instability. External manipulation of the thorax such as percussion or vibration, is contraindicated in the presence of subcutaneous emphysema; a recent skin graft or myocutaneous flap procedures on the thorax; burns, open wounds or skin infections of the thorax, rib fractures flail chest, osteomyelitis or osteoporosis of the ribs, soft tissue injuries to the thorax or complaints of chest wall pain due to other causes; temporary transvenous pacemakers; suspected pulmonary tuberculosis, pulmonary embolus, pulmonary contusions, or bronchopulmonary fistula; large pleural effusions or undrained empyema, increased intracranial pressure or other unstable intracranial pathology; unstable spine injuries or recent spine surgery; active hemorrhage with hemodynamic instability, severe or uncontrolled coagulopathies; and *confused and combative patients* who do not tolerate physical manipulations."

"Another hazard associated with chest physical therapy is the development of *hypoxemia* during the procedure. In many cases, initiating oxygen therapy or increasing oxygen concentration during chest physical therapy can treat this. The decision to use chest physical therapy requires assessment of the potential benefits versus potential risks and limitations. Therapy should be provided for no longer than necessary to obtain the desired therapeutic results." Peruzzi WT, Smith B. Bronchial Hygiene Therapy. *Crit Care Clin* 1995; 1: 79-96. See also AARC Clinical Practice Guidelines: Postural Drainage Therapy. *Respir Care* 1991;36: 1418-1426.

[16] Button BM, Heine RG, Catto-Smith AG, Phelen PD. Postural drainage in cystic fibrosis: is there a link with gastro-oesophageal reflux? *J Paediatr Child Health* 1998; 34:330-334.

[17] Button BM, Heine RG, Catto-Smith AG, Phelen PD, Olinsky A. Postural drainage and gastro-oesophageal reflux in infants with cystic fibrosis. *Arch Dis Child* 1997;76(2): 148-150.

[18] Ledson MJ, Tran J, Walshaw MJ. Prevalence and mechanisms of gastro-oesophageal reflux in adult cystic fibrosis patients. *J R Soc Med* 1998; 91(1): 7-9.

[19] Lapin CD. Conventional postural drainage and percussion: is this still the gold standard? *Pediatr Pulmonol* Suppl 1994; 10: 87-88.

[20] Williams MT. Chest physiotherapy and cystic fibrosis: why is the most effective form of treatment still unclear? *Chest* 1994; 106: 1872-1882.

[21] Sutton PP. Chest physiotherapy: time for reappraisal. *Br J Dis Chest* 1988; 82: 127-137.

[22] Prasad SA, Main E. Finding evidence to support airway clearance techniques in cystic fibrosis. *Disabil Rehab* 1998; 20 (6/7): 235-246.

[23] Thomas J, Cook DJ, Brooks D. Chest physical therapy management of patients with cystic fibrosis: a meta-analysis. *Am J Respir Care Med* 1995; 151: 846-850.

[24] Ibid.

[25] Sutton, op. cite (n. 17).

[26] "… Compliance with PD&P therapy is low, ranging from 40-47% of patients performing CPT as prescribed." This poor compliance seriously detracts from using PD &P as a gold standard, for how can one extrapolate trends from a study where patients are twice as compliant as they are in real life?" Lapin CD. Conventional postural drainage and percussion: is this still the gold standard? *Pediatr Pulmonol* Suppl 1994; 10: 87-88.

[27] Selsby D, Jones JG. Some physiological and clinical aspects of chest physiotherapy. *Brit J Anaesthesiol* 1990; 64:621-631.

[28] Mackenzie CF [correspondence]. *Brit J Anaesthesiol* 1990; 65:147.

[29] Wright EC. Non-compliance—or how many aunts has Matilda? *Lancet* 1993; 9; 342(8876): 909-913.

[30] Coates AL. Op. cite (n.1).

[31] Williams MT. Chest physiotherapy and cystic fibrosis: why is the most effective form of treatment still unclear? *Chest* 1994; 106:1872-1882.

[32] Conway SP, Pond MN, Hamnet T, Watson A. Compliance with treatment in adult cystic fibrosis. *Thorax* 1996; 51(1): 29-33.

[33] Abbott J, Dodd M, Bilton D, Webb AK. Treatment compliance in adults with cystic fibrosis. *Thorax* 1994; 49(2): 115-120.

[34] Paterson JM, Budd J, Goetz D, Warwick WJ. Family correlates of a ten-year pulmonary health trend in cystic fibrosis. *Pediatr* 1993; 91: 383-389.

[35] Passero MA, Remor B, Salomon J. Patient-reported compliance with cystic fibrosis therapy. *Clin Pediatr* 1981; 20: 264-268.

[36] Fong S, Dales R, Tierney M. Compliance among adults with cystic fibrosis. *Pediatr Pulmonol* 1988;5 (Suppl 120): 140.

[37] Currie DC, Munro C, Gaskill D, Cole PJ. Practice, problems, and compliance with postural drainage: a survey of chronic sputum producers. *Br J Dis Chest* 1986; 80:249-253.

[38] Davids LM, Heneley LD. Investigation into the compliance with and effectiveness of physiotherapy regimen in CF. *S Afr J Physiother* 1990; 46:7-10.

[39] Muszynski-Kwan AT, Perlman R, Rivington-Law B. Compliance with and effectiveness of chest physiotherapy in CF. *Physiother Can* 1988;40: 28-32.

[40] Langendefer B. Alternatives to percussion and postural drainage: A review of mucus clearance therapies: percussion and postural drainage, autogenic drainage, positive expiratory pressure, flutter valve, intrapulmonary percussive ventilation, and high-frequency chest compression with the therapy vest. *J Cardiopulmonary Rehabil* 1998;18:283-289.

[41] AARC Clinical Practice Guidelines: Postural Drainage Therapy. *Respir Care* 1991;36: 1418-1426.

[42] St. Coeur M (ed.). *Case Management Practice Guidelines*. St. Louis, Missouri: Mosby Yearbook, Inc., 1998. 14:1-14:6.

[43] Murphy TM, Rosenstein BJ. *Advances in the Science and Treatment of Cystic Fibrosis Lung Disease: A Continuing Education Resource.* Raleigh, North Carolina: Duke University Medical and Health System, 1998.

[44] Beers MH, Berkow R (eds.). *The Merck Manual of Diagnosis and Therapy*, 17th Edition. Whitehouse, New Jersey: Merck Research Laboratories, 1999. 2369.

[45] The Vest™ system has been prescribed for patients with complications associated with, *inter alia*, bronchiectasis, asthma and COPD, neuromuscular disease, cerebral palsy, high-level spinal cord injury, complications of heart-lung or double lung transplantation, and artificial airway/ventilator dependency.

[46] In a formal study of adherence to The Vest system therapy, data was compiled for 82 patients who were instructed to use The Vest system at least 15 minutes daily. During the first arm of the study (51 ± 21 (SD) days, patients used The Vest™ system for an average

of 16± 12 minutes per day, and 41% used The Vest system for more than 15 minutes per day. During the last interval of the study, after The Vest therapy for a mean of 9 months (range 6-21 months), patients used The Vest system for 18± 13 minutes daily, and 52% of patients used The Vest system for more than 15 minutes per day. Anbar RD. Compliance with use of ThAIRapy® Vest by patients with cystic fibrosis. Department of Pediatrics, State University of New York Health Science Center, Syracuse, NY, USA.

[47] Data collected by Advanced Respiratory, Inc.