

# **Cerebral Palsy with Acute Aspiration Pneumonitis: A Case Study**

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# Case Study:

## Cerebral Palsy with Acute Aspiration Pneumonitis

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Respiratory complications are a frequent cause of morbidity and mortality<sup>1</sup> among patients with cerebral palsy (CP). Such patients experience a high incidence of dysphagia and gastroesophageal reflux.<sup>2</sup> Consequently, they are prone to aspiration of oral and gastric contents. Frequent aspiration can lead to recurrent infections, aspiration pneumonia, and progressive damage to the pulmonary defense system.<sup>3</sup> Limited mobility, poor control of the glottis, and dyscoordination of the muscles required to produce an effective cough contribute further to impaired airway clearance. Such dysfunctions frequently result in serious and persistent intra-pulmonary infections and increased production of mucus. To prevent or manage such complications, consistent, effective airway clearance therapy is often an important component in the care of CP patients.

Typically, CP patients also suffer from skeletal deformities including scoliosis, kyphoscoliosis, and lordosis.<sup>4</sup> As a result, they are often unable to tolerate the positioning required for the postural drainage component of the conventional chest physiotherapy (CPT) most frequently prescribed to accomplish airway clearance. In addition, when copious retained secretions are present, Trendelenburg positions can create shunting that leads to hypoxemia and additional stresses on the cardiopulmonary system. Other airway clearance treatment modalities, such as PEP, IPV and the Flutter Valve, are frequently unsuitable for use by CP patients. These methods are at least partially dependent on techniques difficult or impossible for patients with impaired muscle strength and coordination to perform effectively.<sup>5</sup> In the case described below, a technique independent method, high-frequency chest wall oscillation (HFCWO) delivered via The Vest™ Airway Clearance System, was used successfully to facilitate airway clearance in a CP patient suffering from acute aspiration pneumonitis.

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### Case Summary

The patient is a 24-year-old Hispanic female with cerebral palsy and accompanying kyphoscoliosis. She also has a history of seizures and gastroesophageal reflux (with a gastrostomy tube in place). Due to the severity and chronic nature of her problems, her medical chart included a do-not-resuscitate (DNR) order. The patient was admitted to the hospital with right upper lobe pneumonia and diminished consciousness. She responded only to noxious stimulus (suctioning). Her airway control was minimal, and she demonstrated rhonchi and rales over all fields. Cough was frequent (three-four times per minute) and weak.

The patient was placed in the telemetry unit and given .40 FIO<sub>2</sub> via venti-mask. Gentamycin and ceftazidime were administered intravenously. She also received 2.5mg nebulized albuterol, and, to provide airway clearance, conventional chest physiotherapy (CPT) was administered every four hours for the first 11 days.

Because this patient had a DNR order, she could not be intubated for airway clearance. Attempts to administer CPT resulted in increased agitation, which the health care team feared was exacerbating her already depressed blood oxygen levels. Moreover, due to the severity of OR's skeletal deformities, she could not be properly positioned for postural drainage. Her mental condition and compromised consciousness precluded the application of other airway clearance modalities (PEP, Flutter, IPV). The only remaining option was a technique-independent method utilizing high-frequency chest wall oscillation (HFCWO). Such therapy was initiated using the Model 102 Vest system.<sup>6</sup>

### Methods

The Vest™ system, manufactured by Hill-Rom, consists of an air-pulse generator attached to an inflatable vest that covers the entire thorax. When the generator is turned on, the pressure in the vest increases and decreases between five and 25 times per second, thereby applying rapid oscillations to the patient's chest wall. This procedure is called high-frequency chest wall oscillation, or HFCWO. HFCWO has been shown to produce transient increases in airflow at low lung volumes, cough-like shear forces, alterations in the physical properties of mucus, and consequent increases in mucus mobilization. Because The Vest™ system operates according to a mechanism entirely different from traditional CPT, it provides effective airway clearance independent of postural drainage.

The patient was treated with The Vest™ system every four hours from 0600 to 2300 hours each day, with the option of additional treatments during the night. Each of The Vest™ system treatments was performed for a total of 15 minutes at a pressure setting of 5.5 and a frequency of 13 Hz, simultaneous with the patient's normal nebulized beta-agonist therapy and continued oxygen. During each of The Vest™ system treatment, therapy was interrupted at seven minutes for oral-tracheal suctioning.

### Results

The patient tolerated The Vest™ system treatment modality well. Following therapy, she produced large quantities of frothy white secretions, followed by thicker, more tenacious mucus. Initially, she required frequent suctioning for approximately 15 minute intervals after each HFCWO treatment, but following such treatments, she showed a decrease in rhonchi.

On the morning after her first therapy treatment with The Vest™ system, the patient's pulmonary status had improved sufficiently that her supplemental oxygen was decreased to .30 FIO<sub>2</sub> via venti-mask.

Two days after initiation of The Vest™ therapy, her condition had improved enough to permit her transfer from the telemetry unit to a regular medical-surgical floor.

Five days after the first treatment with The Vest™ system, and 16 days after her initial admission through the emergency department, she was discharged with orders for the maintenance of airway patency through suctioning, but with no orders for airway clearance therapy or supplemental oxygen. At discharge, she was considerably more alert, and the pneumonia had resolved.

**Table I.** Arterial blood gases at admission (on .30 FIO<sub>2</sub> via venti-mask); just prior to the first treatment with The Vest™ system (on .40 FIO<sub>2</sub> via venti-mask); and at discharge (on .25 lpm nasal O<sub>2</sub>):

Blood Gas	Admission 1/13	1/22	Discharge 1/28
pH	7.18	7.33	7.46
PaCO <sub>2</sub>	35	76	46
PaO <sub>2</sub>	80	81	68
HCO <sub>3</sub>	16	40	

Four days after discharge, the patient was readmitted in respiratory distress as a result of aspiration. At admission, oxygen, HFCWO, IV antibiotics and nebulized beta-agonist therapies were reinitiated. Five days later, she was again discharged. Her orders now included continuation of both HFCWO treatment and suctioning at home. In the twelve month period following discharge, this patient has required no further hospitalizations, and has been seen only on a routine basis in the neurology clinic. Her elderly mother has been able to administer effective airway clearance treatments with The Vest™ system, and the patient has experienced no further episodes of acute respiratory infection. She has been able to remain at home and has required neither supplemental oxygen nor nebulized medications. Her mother, who is her primary caregiver, has stated that HFCWO therapy is easy to administer and that ease of treatment has had a positive impact on the consistency of the treatments she has been able to provide for her daughter.

## Discussion

Because this was not a formal study with controlled variables, it is impossible to conclude precisely how much HFCWO contributed to this patient's unexpected recovery and release from the hospital. Neither is it possible to assess the impact of continued home HFCWO therapy on the patient's apparent clinical improvement and freedom from relapse. However, in addition to antibiotic therapy, The Vest™ system

was the only significant variable used in the treatment of this desperately ill young woman for whom heroic interventions were contraindicated. Our experience with her case suggests at least two areas for further research: What role might regular HFCWO airway clearance therapy play in preventing or reducing serious respiratory complications among a selected subset of the CP community? What might be the quality of life benefits conferred upon both CP patients and their caregivers by the regular use of a non-invasive, non-posture-dependent airway clearance system? As the population of chronic disease patients increases, the identification and implementation of effective ameliorative therapies is imperative.

## References

<sup>1</sup> An analysis performed by the National Institute of Child Health and Human Development in cooperation with the National Center for Health Statistics revealed that, in 1987, respiratory complications accounted for 42.1% of deaths for which cerebral palsy was identified as an underlying cause on the death certificate. UCP Research & Educational Foundation. "Causes of Death of Persons with Disabilities Due to Cerebral Palsy." November 1995. <http://www.ucpa.org/html/research/death.html>

<sup>2</sup> It is estimated that at least 40% of people with cerebral palsy have some degree of dysphagia, and the incidence of gastroesophageal reflux among CP patients is cited as high as 75%. Pronnicki J. Presentation symptomatology and etiology of dysphagia. In Rosenthal SR, Sheppard JJ, and Lotze M, eds. *Dysphagia and the Child with Developmental Disabilities*. San Diego: Singular Publishing Group, 1995. 1-14.

<sup>3</sup> Bartlett JG and Gorbach SL. The triple threat of aspiration pneumonia. *Chest* 1975; 68(4): 560-566.

<sup>4</sup> Scoliosis affects anywhere from 4-64% of the CP population, depending upon the severity of the CP. Dias RC, Miller F, Dabney K, Lipton GE. Revision spine surgery in children with cerebral palsy. *Journal of Spinal Disorders* 1997; 10(2): 132-144.

<sup>5</sup> Even routine pulmonary function tests can be a challenge for people with severe cerebral palsy, since they are unable to hold a mouthpiece reliably. Miyasaka K, Hoffman HF, Froese AB. The influence of chronic cerebellar stimulation on respiratory muscle coordination in a patient with cerebral palsy. *Neurosurgery* 1978; 2(3): 262-265.

<sup>6</sup> The Model 102 is an older model of this device; following this case, the hospital obtained the newer Model 103.