

High-Frequency External Chest Wall Compression for Secretion Clearance: Shake It, But Don't Break It

In 1983, King and colleagues, at the Meakins Christie Laboratories in Montréal, documented that high-frequency chest wall compression (HFCWC) markedly enhanced tracheal mucus clearance in anesthetized dogs.¹ They speculated that this may benefit patients with mucus-clearance disorders, and in 1990 Hansen and Warwick first reported the development of an HFCWC device that enhanced mucus clearance in patients with cystic fibrosis (CF).² This device was commercially developed and sold as The Vest, which is one of the best studied airway clearance devices in use today.³ Well-controlled studies have demonstrated that HFCWC is equivalent to chest percussion and postural drainage for promoting airway clearance in patients with CF, and patient preference (and perhaps adherence) favors HFCWC.^{3,4}

In contradistinction to the extensive data on HFCWC in patients with CF, as of this writing there are no published, well-controlled, randomized clinical trials of HFCWC in patients with neuromuscular disease.⁵ Observational studies of HFCWC suggest that it might reduce the frequency of hospitalization for pneumonia in children with cerebral palsy⁶ or familial dysautonomia.⁷ One small randomized prospective trial in patients with amyotrophic lateral sclerosis found that the addition of HFCWC airway clearance did not provide any clinical benefit for these patients,⁸ whereas another short-term study found that HFCWC appeared to reduce the sensation of breathlessness in patients with amyotrophic lateral sclerosis.⁹

Because of the paucity of data, there is wide variation in the application of HFCWC in children with neuromuscular disease. Some institutions use HFCWC routinely in patients with neuromuscular disease, whereas others do not use it at all. In the early stages of neuromuscular disease, severe pneumonia is a rarity, probably because mucociliary clearance is preserved. This is quite different from patients with CF, who have impaired secretion clearance from birth. HFCWC only minimally increases mucociliary clearance. HFCWC's primary effect is to mobilize secretions to the proximal airway, where they can be more effectively expectorated. It is important to note that HFCWC is not a *substitute* for an effective cough, but rather is meant to enhance the effectiveness of coughing. Most patients with CF have well-preserved cough flow, whereas many patients with neuromuscular disease have

an impaired cough, and this is thought to contribute to their risk of pulmonary infection with progressive disease. Thus, we would expect HFCWC to be less effective in patients with neuromuscular disease, and perhaps detrimental for those with severe inability to clear their proximal airways by coughing.

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This raises the issue of safety. Again, there are very few data outside of CF trials where HFCWC has been well tolerated by most patients. Chest physical therapy can have adverse effects, including pain and gastroesophageal reflux.¹⁰ Although this has not been evaluated for HFCWC, it is possible that the risks are similar. In this issue of *RESPIRATORY CARE*, the authors present a case report of a child with cerebral palsy who had documented acute hypoxemia in association with application of HFCWC.¹¹ Willis and Warren hypothesize that the hypoxemia was due either to reflux (with aspiration of gastric contents) or to mobilization of secretions that could not be expectorated. This episode led to a prolonged pediatric intensive care admission and eventual placement of a permanent tracheostomy. Following discharge from hospital there were no further adverse events with the resumption of HFCWC therapy.

A cause-and-effect relationship is difficult to determine, especially in observations on a single subject. This is true for both adverse events and perceived benefits. Although it could be argued that theoretically we would expect no benefit from HFCWC in patients with severe neuromuscular dysfunction, this must be studied in a randomized prospective controlled and appropriately powered clinical trial. Likewise, anecdotal reports of adverse events do not provide solid evidence that HFCWC is dangerous for these patients, but it should increase the physician's caution in prescribing very expensive and as yet unproven therapy in these medically fragile children.

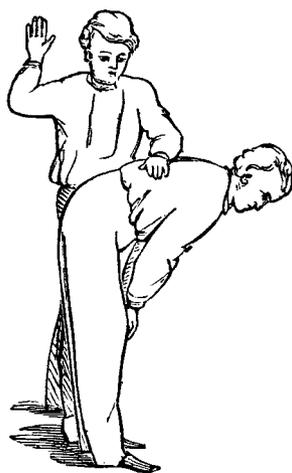
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