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Breathing Easier: Airway Clearance Using High-Frequency Chest Wall Oscillation

by Susan Agrawal

Children with a wide variety of medical conditions may have difficulty breathing due to pooled secretions in their airways or an inability to produce an effective cough. These children, who have conditions including cystic fibrosis, muscular dystrophy, spinal muscular atrophy, mitochondrial diseases, or cerebral palsy, often require intensive interventions to help them breathe.

One intervention, an airway clearance system that oscillates or vibrates the chest wall, can be extremely effective for loosening up pooled secretions in the lungs and upper airway, clearing the lungs and allowing a child to breathe much more easily.

High-Frequency Chest Wall Oscillation: A Big Term For a Simple Process

For thousands of years, people have been assisting children with respiratory problems by performing percussion, often known as Chest Physical Therapy (CPT), on the child's back and chest. This technique, which involves using a cupped hand or specially designed cups to rhythmically hit the back and chest, loosens up congestion in the lungs and throughout the airway. Some people also combine CPT with vibration techniques, either using their hands or vibrating devices, to further loosen secretions.

While CPT performed correctly works very well, it can be difficult to perform, as it requires a great deal of physical effort. In addition, caregivers must be trained to perform the technique appropriately, and its effectiveness will depend on their skill level.

An alternative to CPT is high-frequency chest wall oscillation (HFCWO), more commonly called an airway clearance vest. This vest uses a small generator attached to a vest worn by the child to vibrate the chest and loosen secretions. The vest inflates and deflates, up to 25 times per second, literally shaking the secretions out of the chest. These can be thought of as "mini-coughs" that loosen thick secretions and help mobilize them out of small airways, allowing them to be coughed out or suctioned.

The advantages to this airway clearance system are tremendous. It requires literally no skill to hook up and run, and even a school-age child can set it up appropriately. It can be used as often as required without fatigue to the caregiver. Most importantly, these vests really work, and make a tremendous difference for many children.

There are several different types of HFCWO systems available. The two major ones available in the United States are The Vest by Hill-Rom and Smart Vest by Electromed. Both companies will help secure insurance approval for the equipment and provide extensive support.

Vest Airway Clearance Treatments

A vest is placed on the child, either wrapping around the chest with Velcro, or strapping over the entire chest or trunk using shoulder straps. One or two hoses, depending on the brand, are then attached between the vest and the generator. The vest then is inflated and the therapy session begins with progressively more rapid inflation and deflation. Settings, including the frequency (how rapidly it inflates and deflates), the length of the session, and how much the vest inflates may be programmed in individually for each child. Some models also allow you to preset a program, which may include a slower frequency at the beginning and end.

The therapy is typically performed twice a day for 20 to 30 minutes when the child is well, and as frequently as every three to four hours when the child is sick. Most children enjoy the shaking/vibrating sensation of the device. Young children who are able to produce sounds often enjoy vocalizing during sessions, because the device distorts their voices. Vest airway clearance systems can be used in any position, as long as the head is elevated slightly to prevent aspiration in children who choke on their secretions.

These systems should not be used in children who have unstable orthopedic issues of the head or neck. They should also be avoided in children with active bleeding or hemorrhage.

While vest airway clearance systems can be used alone, it is common to also use them with medications or other assistive devices. Albuterol, Xopenex, and similar medications may be given before (using an inhaler) or during (using a nebulizer) treatment sessions. Pulmozyme, an inhaled medication that can help thin secretions, may also be used with vest airway clearance systems, as can hypertonic saline, an extra salty inhaled mist that can thin secretions.

Cough assist devices, or mechanical insufflator-exsufflators, may also be used after vest airway clearance treatments to help cough up the loosened secretions. Suctioning of secretions, either through a tracheostomy or deep suctioning through the mouth, may also be performed after treatments to remove secretions.

Insurance Coverage

These systems typically cost around $15,000 and cannot be purchased out-of-pocket by most families. Children with certain diagnoses, including cystic fibrosis and

degenerative neuromuscular diseases, can usually obtain insurance coverage for vest airway clearance systems with ease.

While these systems also benefit children with severe cerebral palsy and similar diseases, it can be very difficult to get insurance to cover the cost. Children who have a diagnosis of bronchiectasis (dilation and scarring of airways), regardless of cause, are usually eligible for coverage, if they have a daily cough or two or more exacerbations per year requiring antibiotics, and have failed to improve with manual percussion or CPT.

Children who do not have a diagnosis of bronchiectasis still can get these devices approved, but it is much more difficult. In general, proof that the device can prevent respiratory complications and hospitalizations is the best way to show the financial benefit of purchasing such an expensive device.

Websites for both The Vest and SmartVest contain literature, including studies and position papers, on the benefits of airway clearance vests in a wide variety of diagnoses. These may be used to assist you in obtaining insurance coverage for one of these devices.

Benefits of Vest Airway Clearance Systems

Many children experience a dramatic reduction in pneumonias, a less frequent need for antibiotics, easier breathing, higher oxygen levels, and an overall improvement in energy and quality of life. These systems may also help to reduce the number of hospital stays by preventing serious respiratory infections.

Contact your child's pulmonologist if you think a vest airway clearance system may be appropriate for your child.