

Airway Clearance Indications: Neuromuscular/Neuromotor Disorders

Spinal Cord Injury/Quadriplegia

Approximately 200,000 people in the United States live with spinal cord injuries resulting in partial or complete paralysis. The severity of paralysis depends on the location and extent of the injury. According to a fact sheet from the Spinal Cord Injury Information Network “the higher the spinal cord injury is on the vertebral column, or the closer it is to the brain, the more effect it has on how the body moves and what one can feel.” Approximately 11,000 new spinal cord injuries are reported each year, with 82% involving males between the ages of 16-30. The vast majority of spinal cord injuries occur as the result of trauma, but certain disease and conditions can damage to the spinal cord, as well. The most serious impairment occurs when the spine is damaged high in the cervical (neck area) with resulting paralysis affecting all four limbs and possibly even the muscles required for respiration.

What Happens in Spinal Cord Injury/Quadriplegia?

In adults, the spinal cord is an 18 inch long bundle of nerve fibers that run from the base of the neck to the waist. It is encircled and protected by bony rings called vertebrae. The brain and spinal cord constitute the body’s central nervous system and regulate voluntary movement, involuntary body functions and physical and emotional responses using nerve impulses that travel along nerve fibers to the spinal column and brain. When the spinal cord is damaged, nerve impulses are not communicated to the brain and movement and function may be impaired or lost altogether.

Respiratory complications such as pneumonia, atelectasis, retained secretions and respiratory failure account for the majority of morbidity after a spinal cord injury. There are a number of factors that contribute to this, including:

- Respiratory muscle weakness resulting in an ineffective cough and difficulty taking deep inspiratory breaths.
- Possible cognitive deficits sustained as part of the injury or from medications.
- Diaphragmatic muscle dysfunction with increased risk of aspiration of gastric contents.
- Mucus hypersecretion, which can occur in as many as 20% of quadriplegia cases from impairment of the peripheral sympathetic nervous system.
- Stagnant secretions which accumulate in the airways from reduced cough activity and immobility.
- Dysphagia or aspiration associated with tracheostomy and/or cervical spine surgery.
- Introduction of pathogens into the airway associated with ventilator-dependence.

Ineffective cough due to weakened respiratory muscles and the inability to manage oral secretions due to inadequate bulbar (swallow) function can contribute to impaired airway clearance. Oral secretions that can’t be swallowed may be aspirated into the airways



overwhelming the mucociliary clearance system. Ineffective cough compounds the problem and a vicious cycle of secretion retention, infection, inflammation and airway damage may set in. Additionally, many individuals with serious spinal cord injury may require ventilatory support. Ventilator-associated pneumonia and other respiratory infections are well-documented complications of prolonged ventilator dependence and create additional risk factors for compromised airway health in spinal cord injury.

How Airway Clearance Therapy Can Help Spinal Cord Injury/Quadriplegia

There is currently no known cure for patients with spinal cord injuries. The goal of treatment is to maximize function and maintain or improve quality of life. Keeping the airways clear of excess secretions and thereby reduce the incidence of inflammation and/or infection and is crucial to maintaining respiratory health. Airway clearance therapy using High Frequency Chest Wall Oscillation (HFCWO) has been demonstrated by clinical study to promote excess mucus clearance and improve bronchial drainage. Shear forces are created by HFCWO treatment that mechanically releases adhered secretions from the walls of the pulmonary tract. HFCWO has also been shown to reduce the viscosity of secretions which significantly improves mobilization of excess mucus. By replicating cough, HFCWO can effectively mobilize pulmonary secretions from smaller airways to larger airways where they can be coughed out, swallowed or suctioned.

For More Information on Spinal Cord Injury/Quadriplegia:

1. Fact sheet from the Spinal Cord Injury Information Network:
<http://www.spinalcord.uab.edu/show.asp?durki=22408>
2. Fact sheet from the National Spinal Cord Injury Association: <http://www.spinalcord.org/>
3. Fact sheet from the Mayo Clinic:
<http://www.mayoclinic.com/health/spinal-cord-injury/DS00460>
4. Fact sheet from the National Institute of Neurological Disorders and Stroke (NINDS):
<http://www.ninds.nih.gov/disorders/sci/sci.htm>