Device for Unblocking and Removing Secretions from Airways (DURSA)

Background, Motivation, and Need

Airway secretions are a major component in the pathophysiology of different disease states: Bronchiolitis, Chronic Obstructive Pulmonary Disease (COPD), Cystic Fibrosis (CF) and many more. Small children airways are more susceptible to airway obstruction due to secretion because of smaller airways cross sectional area. Bronchiolitis is only one example where secretions blocking the airway are a hallmark of disease, and assisting in conveyance of secretions from lower airways is essential for effective treatment. COPD, a common respiratory condition characterized by airflow limitation caused by a combination of small airways disease, alveolar septa destruction and impaired secretions clearance. It affects more than 5% of the population and is associated with high morbidity and mortality. It is the third-ranked cause of death in the United States, killing more than 120,000 individuals each year. As in bronchiolitis, it is widely believed that the fundamental pathophysiology of COPD is related to closure of small airways due to inflammation resulting in loss of alveolar septa tethering of these airways and excess secretions. These changes diminish the ability of the airways to remain open, particularly during expiration. To date there is no effective therapeutic modality that directly or indirectly treats the small airways. As such, the overall ability to improve the pulmonary functions, the functional capacity and the perceived wellbeing of COPD patients is suboptimal. These pediatric and adult patients are in need of daily respiratory physiotherapy support both at home and in a hospital setting.

The solution and the current development stage

Development of a novel non-invasive device that aims to treat the core of the airways pathophysiology diseases – the "small airways disease", introducing pressure and acoustic pulses carried into the lungs over a low-pressure airstream. The device applies a combination of low frequency flow oscillations and high frequency acoustic waves to facilitate removal of mucus by breaking down or agglomerating mucus chunks, detaching them from the wall, and facilitating transport. The two kinds of waves are applied simultaneously. At first the flow pulsations dominate and they penetrate the mucus and then the acoustics waves dominate in "chopping it into fragments", allowing the lung an easier mucus push-out. The detachment of the mucus from the airway wall is accomplished by a combination of flow and acoustic pulses that match the resonance of specific airway sections and thus amplifying the effect by impedance matching principle. To optimize these steps, algorithm is developed to match the required frequencies, amplitudes, duty cycle, and relative phases to the specific patient's geometry. *This is a joint project of Ben-Gurion University of the Negev, Beer-Sheva, Israel and Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA.*

The Market opportunity

The device is indicated as a lung expansion device that creates vibro-acoustic air pressure pulses and applies Positive Expiratory Pressure (PEP) as a patient breathes through the device. Patient Population: Cystic fibrosis, COPD, asthma, bronchiolitis and lung diseases with secretory problems, patients with neuromuscular disease affecting the ability to effectively cough.

Patent Status

Provisional patent pending

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