

Selection of the Type of Mechanical Ventilation Methods for Patients with COPD and its Goals

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Opinion Article

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ABOUT THE STUDY

About 10%-15% of patients with chronic obstructive lung disease develop respiratory failure and patients with COPD have core pulmonate. COPD is often associated with acute exacerbations of symptoms. In moderate to severe COPD, an exacerbation is associated with not only increased cough, sputum production and breathlessness but often acute respiratory failure. The mortality o COPD patients admitted to hospital for an acute exacerbation is approximately 10% and the long term outcome is poor. Hospitalization for acute exacerbations leads to a significant healthcare burden. Ventilatory support one of the active medical intervention measures, is of great importance in the management of COPD patients with acute exacerbation.

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Rationale for mechanical ventilation

COPD is characterised by the presence of chronic airflow obstruction often associated with emphysema. This airflow obstruction is caused in part by airway inflammation and in part by the loss of alveolar septal tethering of small airways that accompanies the destructive changes of alveoli. During the chronic process, recurrent acute exacerbations lead to progressive increase in dyspnea and even development of respiratory failure due to the deterioration of airflow obstruction. In patients with COPD inspiratory muscles fatigue may contribute to the development of respiratory failure. In moderate to severe COPD, inspiratory muscles often function poorly for a number of reasons. First, increased airway resistance increases the work load of respiratory muscle. Second, diaphragm flattening and over inflation of the chest cavity often occur as emphysema is worsening because of elevated functional residual capacity. Dynamic hyperinflation has been frequently observed in COPD patients not only during exercise but also during breathing at rest. Both emphysema and dynamic hyperinflation put the inspiratory muscles to mechanical disadvantage leading to increase in work load and decrease in force. This article demonstrated that both increased lung volume and threshold loading caused by dynamic hyperinflation contributed to the development of dyspnoea. Other factors contributing to the weakness of the diaphragms include malnutrition, muscle atrophy, hypoxaemia and hypercapnia. It has been shown that patients with moderate COPD failed to generate higher transdiaphragmatic pressure in response to increased ventilator demand. They developed abdominal paradoxical breathing during incremental maximal exercise suggesting diaphragmatic fatigue. The imbalance between mechanical load and inspiratory muscle capacity predisposes to inspiratory muscle fatigue and pump failure. As lung function deteriorates, hypoxaemia and hypercapnia develop, further reducing the force of inspiratory muscles. The presence of hypercapnia often indicates task failure of the inspiratory pump. Based on the above findings, assisted mechanical ventilation may eliminate inspiratory muscle fatigue and lung volume reduction surgery may improve the inspiratory muscle function in selected patients.

The goals of mechanical ventilation in COPD are as following:

- i. To reverse hypoxemia that has not been corrected with supplemental oxygen delivered either by nasal cannula or face mask
- ii. To reverse severe respiratory acidosis
- iii. To relieve respiratory distress and respiratory muscle fatigue

Methods

Non-invasive mechanical ventilation co-units of intermittent negative pressure ventilation and non invasive positive pressure ventilation *via* face or nasal mask. Both NPV and NIPPV have been used for the management of COPD patients. In general, although NPV is effective in reducing electrical excitation and mechanical activities of inspiratory muscles as well as improving dyspnoea and arterial blood gases in COPD patients, NPV is less effective than NIPPV as it limits the patients activities such as sleep disturbance, oesophageal sphincter dysfunction, development of obstructive apnoea with short inspiratory time. NIPPV is commonly used in management of COPD as it is easily triggered with better synchronization with the patients breathing efforts.