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Domiciliary Painless Ventilation for Constant Respiratory Illnesses

Ravi Kiran*

Department of Cardiology, King George's Medical University, Lucknow, India

Abstract

Patients with chronic respiratory conditions, such as COPD, neuromuscular diseases, kyphoscoliosis, and obstructive sleep apnoea-obesity hypoventilation syndrome (OSA-OHS), are more likely to experience decompensation in the form of hypercapnia respiratory failure, which can result in admission to the intensive care unit (ICU) and an increase in the patient's likelihood of passing away. Domiciliary noninvasive ventilation (NIV) in patients with diseases that cause chronic ventilatory failure is examined in this article, along with its mechanism of action.

Keywords: Respiratory illness; Neuromuscular diseases; Chronic obstructive pulmonary disease

Introduction

Hypercapnia is the cause of type 2 respiratory failure, which is caused by the respiratory system's inability to remove carbon dioxide (CO2). Chronic obstructive pulmonary disease (COPD), neuromuscular diseases, obstructive sleep apnoea-obesity hypoventilation syndrome (OSA-OHS), post-infective lung sequalae and chest wall deformity (early onset scoliosis and postthoracoplasty) are all common causes of hypoventilation and hypercapnia [1-3]. In these conditions, it has been demonstrated that noninvasive ventilation (NIV) is an effective treatment that improves quality of life (QoL) and reduces morbidity and mortality. The role of NIV in chronic lung diseases that lead to respiratory failure will be discussed in the review.

The term "hypercapnia" refers to a rise in the arterial partial pressure of carbon dioxide (PCO2), which can be brought on by either increased CO2 production or decreased minute ventilation. The respiratory system has a huge capacity to increase ventilation, so the latter will typically not be a problem. However, a person with a compromised respiratory system may be able to maintain a normal CO2 until their CO2 production increases while exercising or when they have an accompanying disease. The respiratory pump, which is made up of the chest wall, breathing muscles, and both the central and peripheral nervous systems, provides minute ventilation. This causes the lungs to expand, and deflation almost always occurs passively [4]. Hypoventilation and hypercapnia result from respiratory pump failure. Proper ventilation necessitates a harmonious relationship between the respiratory pump, the load against which it must operate, and the central drive. When respiratory muscle capacity decreases, respiratory muscle load increases, or central drive decreases, ventilatory failure occurs. The decreased central drive is exacerbated during the rapid eye movement (REM) cycle of sleep and is caused by decreased cortical input to the respiratory center. Ventilation is entirely dependent on the diaphragm during REM sleep, with neither the intercostal nor postural muscles being activated. Additionally, there is less input to the muscles of the upper airway, which results in more resistance in the upper airway. The diminished capacity can be the result of intrinsic respiratory muscle weakness, such as in neuromuscular diseases, mechanical disadvantage from chest wall deformity, or COPD-related hyperinflation. The dysfunction of load, drive, and capacity in various chronic lung diseases can result in increased load due to airway obstruction, reduced lung compliance due to loss of lung elasticity, and reduced chest wall compliance.

Literature review

A group of diseases known as neuromuscular diseases (NMDs) affects the nerves that control voluntary muscles and even the muscles in the respiratory system. NMD causes progressive impairment, including difficulty ambulating, difficulties swallowing, worsening muscle weakness in the respiratory system, and ultimately death from respiratory failure. In Western nations, NMD is a frequent cause of increased mortality and morbidity. However, these patients' survival rates have increased as a result of improved technologies like NIV [5,6].

The NMD results in the destruction of muscle fibers, loss of function at the neuron or neuromuscular junction, and loss of central drive. This movement can be intense like in myasthenia emergency, continuous like in solid dystrophy, or quickly moderate like in amyotrophic sidelong sclerosis. NMD's neuromuscular respiratory dysfunction can be broken down by their function into the following categories: (1) inspiratory muscle association prompting debilitated ventilatory capability; (2) inclusion of inspiratory, expiratory and glottic capability, prompting weakened hack and discharge the board brokenness; and (3) the involvement of the glottis causes problems with swallowing and airway protection. The bulbar brokenness in these patients not just prompts gulping and talking challenges with impediment of aviation route emission leeway yet additionally prompts prior improvement or deteriorating of rest scattered breathing because of upper aviation route block [7]. These problems can arise on their own or even in conjunction with other problems. As muscle weakness worsens, alveolar hypoventilation, oxygen depletion, and hypercapnia occur. Due to decreased pulmonary distention caused by micro atelectasis and later macro atelectasis and diminished distensibility of the chest wall caused by muscle weakness–related secondary deformities the inspiratory muscle dysfunction increases the work of breathing [8].

***Corresponding author:** Ravi Kiran, Department of Cardiology, King George's Medical University, Lucknow, India, E-mail: Ravi_kiran@rediffmail.com

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Discussion

Patients with OHS have traditionally been treated with continuous positive airway pressure (CPAP), which has proven to be beneficial by improving gas exchange, resulting in decreased daytime PCO2 and increased arterial PO2 tension. This effect may be due to the fact that in OHS, there is a major component of upper airway collapse, which is improved by both CPAP and bi-level Positive Airway Pressure (PAP). In these patients, domiciliary NIV has been shown to reduce mortality by 5 to 32 percent. They conducted a randomized control trial in which domiciliary NIV outperformed lifestyle changes in terms of daytime PaCO2 and improvement in sleep-disordered breathing. In the Pickwick study, more than 300 patients with severe OSA were shown to benefit from home NIV in terms of daytime PaCO2, sleep parameters, and health-related quality of life. Additionally, functional parameters like FRC, forced expiratory volume in one second, and 6MWT were improved with the use of NIV. Right ventricular dysfunction and pulmonary hypertension, two common cardiac complications in OHS patients, have become more common. Some studies have shown that NIV improves cardiac outcomes by lowering pulmonary systolic artery pressure in patients with increased 6MWT and initial baseline echocardiographic evidence of right ventricular overload. Left ventricular hypertrophy and systolic pulmonary artery pressure both improved as a result of the Pickwick project. The positive effects of NIV are significantly influenced by adhesion.

End-stage chronic lung disease patients frequently experience breathlessness, which has a significant impact on their quality of life. Breathlessness is a common symptom in patients with advanced COPD and end-stage pulmonary cancers. The American Thoracic Society has recommended that these patients receive palliative care and that every effort be made to alleviate this symptom. However, there is little evidence that NIV can be used as a palliative treatment for advanced COPD. The use of NIV in these patients has the potential to relieve tired respiratory muscles, resulting in reduced work of breathing and symptoms. Nava et al. conducted a randomized trial. The Borg scale was used to measure the improvement in dyspnea in 200 solid tumor patients. However, there are a number of obstacles that could prevent NIV from being used widely as a form of palliation, such as the perceptions of patients and caregivers that it could prolong the agony, the uncomfortable mask, claustrophobia, and so on.

Conclusion

QoL is low in people with chronic lung diseases, and they run the risk of decompensation, such as hypoventilation and type 2 respiratory failure. For these patients, NIV is a straightforward and efficient treatment. NIV has traditionally been recommended for neuromuscular patients with chronic respiratory failure.

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Conflict of Interest

None

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