OPINION

The use of non-invasive ventilation in decannulating and weaning critically ill tracheostomy patients

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ABSTRACT

There are many difficulties connected to Invasive Mechanical Ventilation (IMV). There are both short-term and long-term hazards for people who have a tracheostomy placed. Tracheostomies are nevertheless implanted to shorten IMV, aid in weaning, and eventually undergo effective decannulation.

Using the search phrases "non-invasive ventilation," "tracheostomy," and "weaning" (along with synonyms and words that are closely related), we ran a narrative evaluation to find pertinent citations. When weaning from Invasive Mechanical Ventilation (IMV) and/or tracheostomy decannulation, Non-Invasive Ventilation (NIV) was one of the procedures employed in publications that included retrospective or prospective investigations. Patients with tracheostomies made comprised a subgroup of patients on IMV in several studies. The majority of the research mainly involved specialized weaning facilities and individuals with underlying cardiopulmonary comorbidities and disorders. Although not all studies included information on decannulation, those that did report high success rates for weaning and decannulation when utilizing NIV as a supplemental method of weaning patients off ventilators support. After being discharged, a sizable portion of patients required home NIV. The review indicates a potential use for NIV in tracheostomy patients who are being weaned off of their ventilator or who are having their tracheostomy decannulated. To create weaning protocols and more fully understand the function of NIV during weaning, more study is required.

Key Words: *Invasive mechanical ventilation*

INTRODUCTION

With an endotracheal tube, Invasive Mechanical Ventilation (IMV) may result in ventilator-associated pneumonia as well as the onset of other ventilator-related complications like ventilator-induced lung injury, muscular atrophy, diaphragmatic dysfunction, tracheal stenosis, and a need for extensive sedation. Chronic cardiopulmonary illnesses, sepsis, critical illness mononeuropathy, the use of prolonged and excessive sedation, neuromuscular blocking medications, diaphragmatic weakness, tracheobronchial obstruction, ineffective coughing, retained secretion, nutritional and metabolic deficiencies, and more are all factors that can prolong IMV. Patients who require prolonged endotracheal intubation frequently have a tracheostomy. Acute respiratory failure with demonstrated or anticipated extended mechanical ventilation, inability to wean from IMV, upper airway obstruction, and copious secretions are the most frequent indications for tracheostomy. It could reduce hazards including ventilator-associated infections, sinusitis, and laryngeal and tracheal injury that come with chronic endotracheal tube use. It also lessens the need for sedation, increases patient comfort, and decreases airway resistance. As it improves patient comfort, reduces the work of breathing, increases airway accessibility, and advances care both within and outside the intensive care unit, a tracheostomy may help speed up a patient's recovery (ICU). However, there are numerous short- and long-term dangers and difficulties linked with a tracheostomy, or the insertion of an artificial airway in the neck, that are similar to those connected to IMV. The tracheostomy tube is a

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foreign body that can cause respiratory and viral problems as well as hinder swallowing. Additionally, tracheostomy patients are unable to breathe via pursed lips and are devoid of the vocal cords' role in maintaining subglottic pressure. The use of a tracheostomy frequently results in aphonic and a loss of spoken communication. Hemorrhage, trachea structural damage, aspiration, pneumothorax, pneumomediastinum, subcutaneous emphysema, stoma infection, and stoma ulceration are some of the early tracheostomy problems. Tracheal stenosis, granulation tissue formation, tracheomalacia, pneumonia, trachea-arterial fistula, and tracheoesophageal fistula are examples of late problems. Both early and late problems include dysphagia and accidental decannulation. Additionally, tracheostomy-tube-assisted mechanical ventilation is linked to potentially dangerous respiratory episodes and more difficult out-of-hospital care. The most frequent respiratory occurrences in out-of-hospital IMV patients were oxygen desaturation and dyspnea, which necessitated further interventions like bag valve mask ventilation, the requirement for pulmonologist consultation, and the replacement of the tracheostomy tube. New creative ideas are desperately needed for their management as more patients with numerous co-morbidities get tracheostomies and struggle to wean. Weaning off these artificial airways should begin as soon as possible for chronic ventilator-dependent patients with tracheostomies due to the risk of the aforementioned infections and tracheal problems, which further extend the time of mechanical ventilation and increase mortality. Surprisingly, there is little information available on weaning tracheostomy patients from mechanical breathing and subsequent decannulation of the tracheostomy tube. The former requires that the unaided respiratory muscles be able to manage the job of breathing, but the latter is only possible if the airways are open, the glottis is functioning well, and the cough is effective. It is not unexpected that many of these individuals continue to require ventilator support because they are unable to get over these barriers.

Non-Invasive Ventilation (NIV), which enables this transition away from ventilator support, is gaining more and more support. NIV is frequently used to treat patients with acute and chronic respiratory insufficiency as well as those who are unable to breathe completely independently after being intubated. NIV typically doesn't call for sedation, allowing patients to converse, eat, and drink. NIV significantly decreased mortality, weaning failures, ventilator-associated pneumonia, ICU and hospital length of stay, total duration of IMV, and rates of tracheostomy in a Cochrane review of studies comparing NIV with IMV weaning.

The authors discovered through subgroup analysis that COPD patients had a larger mortality benefit than non-COPD patients. The European Respiratory Society (ERS)/American Thoracic Society (ATS) recommendations advise using NIV to ease the transition away from IMV in cases of hypercapnia respiratory failure. In high-risk patients, it can also be administered to stop post-estuation Acute Respiratory Failure (ARF). NIV is not advised for use, though, in the management of patients who have an acute post-estuation respiratory failure that has been established. Although there is a strong physiological basis for the use of NIV in mechanically ventilated patients with tracheostomy tubes to aid in weaning off of the ventilator and removal of the tracheostomy tube, the majority of clinical data comes from small observational trials. Therefore, we did the following literature analysis and provided a narrative review on this subject to better clarify the function of NIV in therapy in these patients with tracheostomies and persistent ventilator failure. We used the terms "noninvasive ventilation," "tracheostomy," and "weaning" in our searches of the Embassy and Medline databases to find pertinent citations. The bibliographies of a few chosen papers have been reviewed. When patients with tracheostomies were weaning from IMV and/or decannulation, one of the procedures employed was NIV. These studies might be retrospective or prospective. The number of patients with tracheostomies, the clinical setting and location of NIV application, the success of weaning patients with tracheostomies from IMV, the success of decannulation of the tracheostomy tube, and the requirement for home NIV after discharge were all considered when analyzing these studies. Consensus recommendations and comments are offered where appropriate, however statistical analysis and high-quality evidence-based recommendations could not be made due to the sparse and varied data available. An imbalance between the workload and the force efficacy of the ventilators pump, which is further constrained by any compromise of the upper airways (for example, bulbar dysfunction, low cough efficacy, vocal cord dysfunction, and airway stenosis and/or edema), are factors associated with difficulties weaning patients with tracheostomies from IMV. Due to a significant decrease in the diaphragmatic contractile force and fiber atrophy during even brief periods of IMV, the diaphragm may become weak. IMV, sepsis, and undernutrition cause oxidative stress and inflammation in the mitochondria, which in turn cause diaphragmatic muscle atrophy and contractile failure. The use of drugs like corticosteroids and neuromuscular blocking medicines, as well as old age, are other variables that contribute to respiratory muscle dysfunction. The ventilator pump's diminished effectiveness plays a part in the imbalance between the work of breathing and the reserve of respiratory muscle. Therefore, training the respiratory pump and minimizing effort imposed during spontaneous breathing constitute the initial stage in weaning from tracheostomy. As they reduce dead space, are typically more pleasant for the patient, and allow a gradual reduction in ventilator assistance until the patient has sufficiently recovered to maintain independent unassisted ventilation, tracheostomy tubes are typically implanted to help to wean. This sometimes entails providing overnight ventilator support while lengthening periods of independent breathing during waking hours until assisted ventilation is no longer necessary.

NIV might be able to ease this transition in a small subset of patients who are unable to stop using mechanical breathing with this method. The physiological benefits of NIV, which include the ability to reduce inspiratory effort and work of breathing, counter intrinsically positive end-expiratory pressure, recruit collapsing alveoli, and therefore promote dynamic compliance, are responsible for this beneficial effect. Additionally, since patients can start NIV with the tracheostomy tube still in place and continue to receive non-invasive support throughout and after decannulation, NIV may be crucial in enabling decannulation. By reducing oro-pharyngeal collapse and possibly lessening the symptoms of vocal cord dysfunction, NIV applies positive airway pressure, which may help maintain upper airway patency. NIV is made more challenging in some individuals because of tracheostomy-related damage to the trachea's continuity and integrity. One method is to use bronchoscopy to check the patency of the upper airways. The tracheostomy can then be capped and NIV can be administered via a facial mask, with the cuff deflated. Decannulation could then be considered after a check for tolerance and clinical stability. In order to wean patients with neuromuscular respiratory weakness or failure of ventilator support, a combination of non-invasive support from the ventilator pump and forced expiratory flow is required. Particularly in patients with neuromuscular respiratory weakness and disorders linked with profuse secretions, Cough Augmentation Techniques (CAT) may play a significant role in secretions management and lowering weaning failure rates Before each period of NIV application, the CAT should be taken because it is a helpful auxiliary. To effectively treat patients with tracheostomies, particularly in light of the weaning process, respiratory high-dependence care units must be developed. It is also critical to emphasize that the decannulation procedure involves a multidisciplinary approach among medical professionals, including nurses, physiotherapists, and speech therapists. Employing volume-controlled intermittent ventilation using a specially tailored face mask, the patient was able to successfully wean off IMV.

Patients who had been weaned were released with home NIV. The majority of the hypercapnia patients had COPD, while the remainder had either thoracic cage problems or neuromuscular disease. These patients were kept off IMV and sent home on NIV. The number of patients who survive ICU admissions and need long-term care as a result of prolonged IMV with a tracheostomy tube in place is rising as medical care develops. Due to the weakened state and poor long-term results of these patients, there are rising healthcare expenses and organizational issues for health systems. Only a few studies have examined the use of NIV in weaning and decannulating tracheostomy patients. According to research contrasting NIV with conventional weaning, NIV may be able to provide enough support to increase weaning and decannulation success rates. The length of the weaning period may be shortened along with the risk of infection. More and more studies are using NIV in the tracheostomy patient weaning process. Most requests specify that NIV is administered via the facial interface with the tracheostomy tube cap on. This appears to make it easier to stop using ventilator support and eventually stop cannulating. To create weaning protocols and evaluate NIV weaning against other weaning methods and techniques in this population, more study is required. The use of High-Flow Tracheal Oxygen (HFT) as an adjuvant or as a substitute for NIV has been discussed. Although HFT permits a more precise FiO_2, delivery through a tracheostomy tube bypasses the upper airways, which could have advantages over a high-flow nasal cannula. When compared to both conventional oxygen and NIV, high-flow oxygen has been utilized to successfully release intubated patients from IMV. Evidence for the assistance that HFT alone or in combination with NIV can provide in facilitating tracheostomy tube removal and decannulation weaning is still missing, nevertheless.