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Role of Non-Invasive Mechanical Ventilation as an Alternative to Tracheostomy in the Weaning of Patients with Acute Respiratory Failure

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Abstract

Tracheostomy is a very frequently performed procedure that is associated with significant morbidity and mortality. There are several complications related to tracheostomy, such as bleeding, stomal infection, pneumonia, tracheoesophageal fistula, tracheal stenosis and others. Due to this situation, other alternatives have been used in the management of acute-on-chronic respiratory failure in subjects who cannot be weaned from ventilator. These patients can be extubated to continuous noninvasive ventilatory support and mechanical insufflation-exsufflation, as it can normalize Oxygen (O_2) saturation, increase vital capacity, and facilitate extubation.

Currents trials in critically ills adults have shown that non-invasive weaning is associated with decreased mortality, ventilator associated pneumonia, length of stay in intensive care and hospital, and total duration of mechanical ventilation. Also, non-invasive ventilation has been investigated as an initial treatment to prevent intubation and intubation related complications and improve clinical outcomes in selected patients.

Keywords

Tracheostomy, Noninvasive ventilation, Weaning

Article

Tracheostomy is a known technique used for weaning from mechanical ventilation. Some patients who were making no progress toward extubation are occasionally weaned from mechanical ventilation soon after tracheostomy [1,2]. This may be due to lower resistance to breathing, less dead space, better secretion removal, improved patient comfort, or need for less sedation. However, no prospective, systematic study of this issue has been performed [2].

Tracheostomy in the1980´s was considered "early" if it was performed before 21 days of translaryngeal intubation. The 3-week time limit of translaryngeal intubation in critically ill patients was based on the belief that the risk ratio (laryngeal risk vs. surgical tracheostomy risk) was excessive if the Endotracheal Tube (ETT) was left much longer than a month. There is little useful, current, objective information to support this belief. Many earlier patients reported with complications were so ill and required such high levels of ventilatory support that it was felt that transport to the operating room and performance of tracheostomy would result in mortality and substantial morbidity. Newer ETT made of less toxic plastics probably are less damaging to the upper airway and larynx and are unlikely to cause as severe injuries as the older tubes [2].

Tracheostomy is related to a high incidence of complications, such as granuloma formation, tracheal ste-

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nosis, tracheoesophageal and tracheopulmonary subcutaneous fistulae, increased food aspiration, bleeding, chronic purulent bronchitis, and sepsis from paranasal sinusitis [3]. It also may produce vocal cord paralysis, laryngeal strictures, hypopharingeal muscle dysfunction, and airway collapse. Tracheostomy was shown to exacerbate endotracheal tube-associated laryngeal damage and increase the risk of laryngeal stenosis, and may also increase dependence on mechanical ventilation [3,4]. Some reports suggested that tracheostomy might actually result in a higher incidence of pneumonia than translaryngeal intubation [2].

There are studies that support that early tracheostomy is associated with a significantly reduced length of ICU and hospital stay and lower risk of pneumonia [5,6]. But we need well-designed randomized controlled trials to confirm it in the future. However, with the demands for Intensive Care Unit (ICU) beds increasing and the clinical changes mentioned, tracheostomy is now being performed earlier in the course of treatment of airway compromise and ventilatory failure [2]. The clinical efficacy of Noninvasive Ventilation (NIV) has been demonstrated in the management of acute-on-chronic respiratory failure of some respiratory disorders, especially in patients with Chronic Obstructive Pulmonary Disease (COPD) [7-9]. NIV could be useful in two situations of extubation and weaning from endotracheal mechanical ventilation: in patients who are difficult to wean, or when the clinician faces difficulties with Conventional weaning techniques leading to extended endotracheal mechanical ventilation [8].

The role of NIV as an extubation and weaning technique can be justified by the various pathophysiologic mechanisms occurring in passage from endotracheal mechanical ventilation to spontaneous breathing. In the case of weaning difficulties, these mechanisms essentially involve respiratory muscle fatigue and altered gas ex- change, which are interdependent. Therefore, the patient will tend to adapt by modifying his or her breathing pattern, usually by increasing respiratory frequency and decreasing tidal volume. These mechanisms correspond to those most often observed during acute exacerbations in Chronic Obstructive Pulmonary Disease (COPD) patients [8,10,11]. However, it is now clearly demonstrated that NIV with either the flow or pressure mode allows respiratory muscle rest, and improves the patient's breathing pattern and gas exchange in this situation. Furthermore, the patients most likely to benefit from NIV would be those with hypercapnic acute respiratory failure, a frequent situation in cases of weaning failure [7,10].

Patients who do not pass ventilator weaning parameters but whose ambient air oxyhemoglobin saturation can be normalized by Mechanical Insufflation-Exsufflation (MIE), including patients with primarily respiratory muscle dysfunction, can be extubated to continuous noninvasive ventilatory support with MIE used to maintain extubation. In subjects with an oxygen saturation lower 95% on room air, MIE improves oxygen saturation, vital capacity, and secretion clearance. The combination of MIE and continuous NIV permit the removal of airway tubes and self-weaning for selected subjects [3,4].

Currents trials in critically ills adults have shown that noninvasive weaning is associated with decreased mortality, ventilator associated pneumonia, length of stay in intensive care and hospital, and total duration of mechanical ventilation. Non-invasive ventilation can reduce the frequency of breathing, increase tidal volume, improve gas exchange, and rest the muscles of respiration [3,7,8,10-12]. NIV can also produce beneficial effects on the cardiovascular function, lowering left ventricle after load and improving cardiac output; however, data about improvement of cardiovascular function are scarce and a mild reduction of the cardiac function due to NIV has been reported. A strict monitoring is required in patients with labile cardiac function [13].

Conclusion

NIV is an effective technique in respiratory failure management in difficult weaning patients, particularly in patients with obstructive disease. In selected patients, NIV reduces morbidity and mortality with out increasing the risk of weaning failure or reintubation.

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