
بسم الله الرحمن الرحيم
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Weaning From
Mechanical Ventilation

- Weaning from mechanical ventilation represents the period of transition from total ventilatory support to spontaneous breathing.

- About 70% of intubated mechanically ventilated patients are extubated on the first spontaneous breathing trial (SBT) attempt, whether by disconnection from the ventilator or after breathing at low levels of pressure support for short periods of time, such as 30 to 120 minutes.

- Unnecessary prolongation of mechanical ventilation increases the risks of complications, including infections (particularly of bronchopulmonary origin), barotrauma, cardiovascular compromise, tracheal injuries, and muscle deconditioning.

- Liberation refers to weaning from mechanical ventilation and means that a patient no longer requires ventilatory support.

- Removal of the endotracheal tube is referred to as extubation.

- The most common reason for weaning failure is respiratory pump insufficiency and is caused by an imbalance between the patient's capabilities and respiratory demands.

Common Disorders That Alter the Balance of Capacity and Load in Critical Illness

Reduced Neuromuscular Capacity

diaphragmatic injury and atrophy, Critical illness polyneuropathy and myopathy, respiratory muscle weakness, malnutrition and deconditioning due to prolonged be rest during critical illness.

Increased Muscle Loads

Increase elastic workloads

pulmonary edema, extreme hyperinflation during an acute asthmatic attack, pulmonary fibrosis, abdominal distension, obesity, trauma, thoracic deformities, presence of intrinsic PEEP,

Increased Resistive work

bronchospasm, excessive secretions, endotracheal tube resistance, ventilator valves/circuits and humidifiers,

Cardiovascular Dysfunction

- The presence of cardiovascular dysfunction can contribute to weaning

failure by augmenting the loads on the respiratory system and by reducing neuromuscular capacity.

- Cardiovascular dysfunction can result from physiologic changes that occur during the resumption of unassisted spontaneous breathing. When spontaneous breathing resumes, the intrathoracic pressure during inspiration is negative. This becomes a situation that results in increased left ventricular preload and afterload.

- It has been recently shown that performing an SBT using a T-tube (instead of pressure support and PEEP) in difficult to wean patients elicits a different cardiovascular response and when support is added (in the form of pressure support and PEEP), respiratory and cardiovascular function both improve.

- In the ICU, there are noninvasive tools (e.g., echocardiography and measurement of plasma B-type natriuretic peptide [BNP]) that help to make the diagnosis of cardiovascular dysfunction.

- Patients in whom weaning failed were successfully weaned after the administration of diuretics.

- The rapid shallow breathing index appears to be the most useful method at the bedside to screen a patient for liberation readiness.

- If the value is less than 105, then 30-120 minutes of an SBT should be used as a confirmation of the capability of breathing spontaneously without assistance.

- since the f/VT has a low specificity (there is a relatively large proportion of weaning failure subjects in whom the test is positive), the f/VT alone is not sufficient to predict weaning failure.

- Patients incapable of protecting their airway and clearing secretions with an effective cough are at an increased risk of extubation failure.

- Patients with a peak expiratory flow equal to or below 60 L/min were five times more likely to have an unsuccessful extubation than patients with expiratory flows greater than 60 L/min.

EXTUBATION FAILURE

- Extubation failure can be defined as reintubation and the reinstitution

of ventilatory assistance within 24-48 hours of extubation.

- Mechanisms explaining extubation failure include impending abnormalities not diagnosed at the time that extubation was performed (e.g., pneumonia or ongoing cardiac failure) and the inability to keep the tracheobronchial tree free of copious secretions.

- Extubation failure results in a marked increase in the duration of mechanical ventilation, ICU and hospital stay, need for tracheostomy, and hospital mortality.

- When patients fail SBTs, pressure support ventilation (PSV) is the modality most often used for the progressive withdrawal of mechanical ventilation.

- The daily interruption of sedation significantly reduced the duration of mechanical ventilation.

PSV

- “optimal” initial levels for PSV are those that provide respirator rates between 25 and 30 breaths/min.

- During weaning, the PSV levels are decreased according to the patient’s clinical tolerance, usually by steps of 2-4 cm H2O at least twice a day.

- In general, clinical tolerance to a level of PSV of about 8 cm H2O without PEEP is required before performing extubation, although this level may vary according to a given patient’s overall clinical status.

Spontaneous Breathing with T-Tube

- Tolerance to breathing through a T-tube represents a good test to evaluate patients' capacity to maintain autonomous, spontaneous breathing.

- The optimal duration of a T-tube trial is at least 30 minutes and no more than 120 minutes.

- The main disadvantage of the T-tube trial is related to the absence of a connection to a mechanical ventilator.

- Since the patients are not monitored by the alarms on the ventilator, they need to be closely supervised.

- the use of T-tube weaning trials in difficult-to-wean patients should be considered since PSV modifies the breathing pattern, inspiratory muscle effort, and cardiovascular response compared to the T-tube in this group of patients.

Noninvasive Ventilation

- Noninvasive ventilation (NIV) could be used in some clinical scenarios during weaning:

➢ Preventive NIV in patients considered high-risk candidates for reintubation

Examples of such patients include those who have hypercapnia at the end of the weaning test and patients with history of heart problems or chronic Hypercapneic respirator failure.

➢ NIV for respiratory failure after extubation

- The high-flow nasal cannula (HFNC) is a relatively new system that delivers heated and humidified oxygen via nasal prongs with a maximum flow of 60 L/min. HFNC provides a low level of positive airway pressure (<4 cm H2O), which is highly dependent on mouth closing.

- Several studies have found that HFNC can be used in weaning period.

CLASSIFICATION OF WEANING

- simple weaning

those patients who proceed from initiation of weaning to successful extubation on the first attempt.(60-70%)

- difficult weaning

those patients who fail initial weaning and

require up to 7 days from the first SBT to achieve successful weaning.(20-25%)

- prolonged weaning

those patients who require more than 7 days from the first SBT to achieve successful weaning.(5-15%)

Thank you