Clinical practice guidelines for weaning critically ill adult patients from mechanical ventilation

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Due to the complications associated with mechanical ventilation, clinicians should implement strategies to liberate patients from mechanical ventilation as soon as the underlying cause for mechanical ventilation has sufficiently improved, and the patient is able to maintain spontaneous breathing unassisted.

**Take-away messages**

Strategies to liberate patients from mechanical ventilation should be implemented as soon as the underlying cause has improved

Efficient liberation processes combine sedation optimization, early mobilization and respiratory management

Recommendations for optimizing the weaning process include use of a ventilator liberation protocol, an SBT with modest inspiratory pressure augmentation, a cuff leak test to screen for laryngeal edema, and NIV after extubation in patients at high risk of post-extubation failure

In 2007, a statement was published summarizing recommendations prepared by a European task force for intensive care medicine. The group recommended classifying patients into three categories according to the difficulty and duration of the weaning process, emphasized the importance of spontaneous breathing trials (SBT) and their duration, and supported the use of pressure support for patients failing an SBT, as well as the use of NIV after extubation in selected patients (1). Since then, several studies have been carried out and resulted in the availability of new evidence. The American Thoracic Society and the American College of Chest Physicians therefore recently collaborated to provide current recommendations for optimizing the liberation of critically ill adult patients from mechanical ventilation (2, 3, 4). These guidelines were developed by means of a systematic review of the literature and an appraisal of the evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework.

**Recommendation 1:** As physicians tend to underestimate the capacity of patients to breathe unassisted and weaning predictors lack sufficient positive and negative predictive value, SBTs should be performed for those patients who have been mechanically ventilated for more than 24 hours and fulfill the readiness-to-wean criteria. An SBT can be performed without inspiratory support, either on T-piece or CPAP, or with modest inspiratory pressure augmentation, either in the form of pressure support or using automatic tube compensation. An SBT with pressure augmentation is more likely to be successful, resulting in a higher rate of extubation success and being associated with a trend towards lower ICU
mortality.

The recommendation suggests that an initial SBT be performed with inspiratory pressure augmentation (5–8 cmH2O) rather than without.

**Recommendation 2:** Mechanically ventilated patients often receive sedatives and analgesics, which may impede liberation from mechanical ventilation. Strategies to minimize the effects of these drugs, such as bedside nursing sedation algorithms or daily sedative interruption, do not show a significant difference in the duration of mechanical ventilation or short-term mortality, but are associated with a shorter ICU length of stay. The recommendation suggests the use of protocols attempting to minimize sedation for patients mechanically ventilated for more than 24 hours.

**Recommendation 3:** In patients with a successful SBT but at risk of extubation failure, noninvasive ventilation (NIV) may be used to prevent reintubation. An assessment of the aggregate data from five randomized controlled studies showed NIV to be superior to standard care in terms of ICU length of stay and short-term mortality. For patients at high risk of extubation failure, who have been mechanically ventilated for more than 24 hours and have successfully passed an SBT, it is recommended to use NIV immediately after extubation. Patients at high risk of extubation failure include those with COPD, chronic heart failure, hypercapnia, and other serious co-morbidities.

**Recommendation 4:** Bedrest during critical illness has a negative impact on many organs, and may induce immobility-related complications or profound weakness in ICU survivors. Those patients for whom rehabilitation is initiated early in the ICU have a shorter duration of mechanical ventilation, and are more likely to be able to walk at hospital discharge. The recommendation suggests using protocolized rehabilitation directed towards early mobilization for patients mechanically ventilated for more than 24 hours.

**Recommendation 5:** Ventilator liberation protocols provide for the systematic screening of readiness-to-wean criteria and performing an SBT when all the criteria are met. These protocols are intended to reduce variability in the assessment of readiness for liberation. They may be implemented by the clinician (respiratory therapist or nurses) or computer-driven. Ventilation liberation protocols are associated with a one-day reduction in the duration of mechanical ventilation and length of the ICU stay, without having a significant effect on overall mortality. The recommendation suggests using a ventilator liberation protocol, either caregiver- or computer-driven, for patients mechanically ventilated for more than 24 hours.

**Recommendation 6:** Laryngeal edema is associated with prolonged intubation and induces post-extubation stridor, which increases the risk of reintubation. A cuff leak test can be used as a surrogate indicator of laryngeal edema and to guide management of patients. Management guided by a cuff leak test decreases both the reintubation and post-extubation stridor rate, but may delay extubation unnecessarily. Furthermore, systemic steroid therapy
reduces both the reintubation rate and post-extubation stridor rate. The recommendation suggests performing a cuff leak test on those patients considered at high risk of post-extubation stridor. Risk factors include traumatic intubation, intubation for longer than six days, a large endotracheal tube, the female sex, and reintubation after unplanned extubation. Administering systemic steroids at least four hours before extubation is also suggested for those patients with a failed a cuff leak test, who are otherwise ready for extubation.

Efficient liberation processes combine sedation optimization, early mobilization and respiratory management. Respiratory management includes use of a ventilator liberation protocol for the early and systematic detection of patients ready for extubation, an SBT with modest inspiratory pressure augmentation, screening for laryngeal edema by means of a cuff leak test in patients at risk of post-extubation stridor, and use of NIV after extubation in patients at high risk of post-extubation failure.

Hamilton Medical ventilators offer tools to assist in implementing these recommendations. In both ASV and INTELLiVENT®-ASV® modes, the ventilator automatically transitions from pressure-control to pressure-support mode when the patient triggers a breath, and gradually decreases pressure support. The ventilation status panel available on every ventilator displays the readiness-to-wean criteria and indicates when an SBT may be considered. In ASV mode, it is possible to perform an SBT with modest inspiratory pressure augmentation by reducing the minute volume (%MinVol). INTELLiVENT-ASV offers a Quick Wean function that not only screens readiness-to-wean criteria, but also performs an automatic SBT and displays the result of the SBT. This mode has been ranked as the best in terms of technological capabilities related to the goal of liberation (5). In addition, the proximal flow sensor on Hamilton Medical ventilators enables a cuff leak test to be performed without disconnecting the patient. All Hamilton Medical ventilators also offer a NIV mode for use after extubation.

* Not available in the US and some other markets

References
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