



REVIEW

## Prolonged weaning: From the intensive care unit to home<sup>☆</sup>



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### KEYWORDS

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**Abstract** Weaning is the process of withdrawing mechanical ventilation which starts with the first spontaneous breathing trial (SBT). Based on the degree of difficulty and duration, weaning is classified as simple, difficult and prolonged. Prolonged weaning, which includes patients who fail 3 SBTs or are still on mechanical ventilation 7 days after the first SBT, affects a relatively small fraction of mechanically ventilated ICU patients but these, however, requires disproportionate resources. There are several potential causes which can lead to prolonged weaning. It is nonetheless important to understand the problem from the point of view of each individual patient in order to adopt appropriate treatment and define precise prognosis. An otherwise stable patient who remains on mechanical ventilation will be considered for transfer to a specialized weaning unit (SWU). Though there is not a precise definition, SWU can be considered as highly specialized and protected environments for patients requiring mechanical ventilation despite resolution of the acute disorder. Proper staffing, well defined short-term and long-term goals, attention to psychological and social problems represent key determinants of SWU success. Some patients cannot be weaned, either partly or entirely, and may require long-term home mechanical ventilation. In these cases the logistics relating to caregivers and the equipment must be carefully considered and addressed.

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**PALAVRAS-CHAVE**

Ventilação Mecânica;  
Desmame;  
Unidade  
Especializada em  
Desmame (SWU)

**Desmame prolongado: da unidade de cuidados intensivos para o domicílio**

**Resumo** O desmame ventilatório é o processo de retirar a ventilação mecânica, que se inicia com o primeiro teste de respiração espontânea (SBT). Baseado no grau de dificuldade e duração, o desmame é classificado como simples, difícil ou prolongado. O desmame prolongado, que inclui doentes que falharam 3 SBTs ou que ainda estão sob ventilação mecânica, 7 dias após o primeiro SBT, afecta um fracção relativamente pequena dos doentes sob ventilação mecânica na UCI mas estes, no entanto, precisam de recursos desproporcionados. Existem diversas causas potenciais que podem levar ao desmame prolongado. No entanto é importante compreender o problema do ponto de vista individual de cada doente, de forma a adoptar o tratamento adequado e definir um prognóstico preciso. Um doente de outra forma estável, que continue em ventilação mecânica, será considerado para transferência para uma unidade especializada em desmame (SWU). Apesar de não existir uma definição precisa, a SWU pode ser considerada como um ambiente altamente especializado e protegido para doentes que necessitam de ventilação mecânica apesar da resolução da doença aguda. Recursos apropriados, objectivos bem definidos a curto e longo prazo, atenção aos problemas psicológicos e sociais são os principais factores determinantes do sucesso de uma SWU. Não é possível obter o desmame ventilatório em alguns doentes, seja parcial ou totalmente, podendo estes necessitar de ventilação de longo prazo, no domicílio. Nestes casos, a logística relacionada com os prestadores de cuidados e o equipamento deve ser cuidadosamente considerada e satisfeita.

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**Introduction**

Generally speaking, weaning is the process of withdrawing ventilator support. Some use the term to intend a gradual reduction of ventilator assistance, while others believe that weaning covers the entire process of liberating the patient from both ventilator and endotracheal tube. A uniform and broadly accepted definition of the term weaning is crucial to avoid confusion and is an essential prerequisite for interpreting the results of the studies, and guiding clinical decisions, including site of care and management of difficult patients.<sup>1</sup>

It is commonly accepted that weaning starts with the first spontaneous breathing trial (SBT), during which the patient is allowed to breath for a relatively brief period of time (30–120 min) through a T-tube, or with low levels of either CPAP (2–5 cmH<sub>2</sub>O) or pressure support ( $\leq 8$  cmH<sub>2</sub>O). When the SBT is successful, the patient is considered weaned and ready to be extubated provided that the natural airway is not at risk of obstruction.<sup>2</sup> A recently proposed and largely accepted classification based on difficulty and duration of the weaning process includes: (1) simple weaning, i.e., the patient passes the initial SBT and is successfully extubated at the first attempt; (2) difficult weaning, i.e., up to three SBT or 7 days from the first SBT are necessary to withdraw mechanical ventilation and extubate the patient; (3) prolonged weaning, i.e., more than three SBTs or 7 days from the first SBT are required.<sup>2</sup>

Because the process of weaning implies two separate, though closely related, aspects, the withdrawal of ventilator assistance and extubation, its complete success is achieved when the patient is able to maintain spontaneous unassisted breathing after extubation. Weaning failure may occur when the patient fails to breathe soon after withdrawal of the

ventilator support, as defined by the incapacity to successfully pass the SBT. Rates of weaning failure after a single SBT of between 26 and 42% have been reported by different studies.<sup>2</sup> Weaning failure, however, is also the need for re-intubation, conventionally within 48–72 h after extubation, so-called extubation failure.<sup>3,4</sup> Extubation failure can be the consequence of the inability, after removal of the endotracheal tube, either to sustain spontaneous unassisted breathing over time, or to maintain a patent upper airway or to clear tracheobronchial secretions.

There are situations, however, in which weaning can only be partially accomplished and it remains work in progress.<sup>2</sup> On the one hand, mechanical ventilation can be applied through a noninvasive interface, commonly a mask covering nose and mouth, referred to as noninvasive ventilation, which allows extubation while continuing to provide ventilator assistance.<sup>2</sup> On the other hand, though successfully disconnected from the ventilator, a patient may still be unable to get the artificial airway removed because of inability to clear secretions or maintain patent the upper airway.<sup>2</sup> The rates of mechanical ventilated patients undergoing a tracheotomy vary among studies and may reach values as high as 25%.<sup>5–7</sup>

Finally, we lack a clear definition of the ventilator-dependent patient. The ninth revision of the International Classification of Diseases defines long-term ventilated patients as those who have received five or more days of ventilation. Some studies use a time limit as short as 48 h, while others as long as 40 days.<sup>8</sup> A limit of two weeks has been adopted by most authors to define the threshold for ventilator dependency and the Health Care Financing Administration has expanded this limit to 21 days of mechanical ventilation for at least 6 h a day.<sup>8</sup> A definition based only on time, however, has limitations because it does not

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