



EDITORIAL

The *magic formula* of weaning: The doctors' *holy grail*

A fórmula mágica de desmame: o *santo graal* dos médicos

In the last 10 years, availability of beds in intensive care units (ICUs) and new technologies coupled with improved levels of care have highlighted a new population of patients defined as *survivors from catastrophic illness*. These patients often require long drawn out weaning procedures.¹ About 80% of patients with acute respiratory failure (ARF) under mechanical ventilation (MV) admitted to an ICU resume spontaneous breathing (SB) quite easily after few days of MV.² The patients discussed here represent less than 10% of ICU admissions but account for a disproportionate burden on health financial resources.¹ To this end, new strategies and protocols for weaning from MV are urgently needed in daily health care.

The weaning process is a delicate phase in the medical history of a patient who has survived an acute episode of ARF and spent a period of time under MV. In fact, during this period, there are a lot of issues that are currently somewhat underestimated in daily medical practice: occupation of beds, healthcare costs, burden to the families and to patients themselves.³

Although these occurrences are quite common and critical, there are no clear guidelines on the minimal criteria required for assessing the correct weaning time for different diseases or on the need for screening criteria prior to SB test (SBT).

It is also crucial to identify the patients who could be considered as likely to respond successfully to the weaning process: *Weaning from Mechanical Ventilation is rarely performed early, often too late.*

Physicians often fail to recognize patients who may be suitable for extubation. Studies about patients who are extubated either accidentally or by themselves demonstrate that 23% of patients receiving full MV and 69% of patients who have begun weaning do not require reintubation.^{4,5} On the other hand, 5–20% of patients who are successfully weaned and possibly extubated need subsequent tracheal reintubation within the next 48–72 h.⁶

For all these reasons, in current clinical practice, there is a complete anarchy in terms of the correct time of

extubation, types of MV needed, how these techniques are used, poor tolerance criteria for SBT, personnel involved in the weaning process, different approaches according to different diseases and clear-cut definition of weaning failure.

Investigation of the influence of different ventilatory supports on predicting breathing pattern variability for extubation outcomes in ICU patients is one of the most common topics in weaning research groups.

A lot of different parameters have been studied to find *the magic formula* for ready-for-weaning or -extubating patients and to discover the best way of ventilation so as to prove the superiority of one over another. Also a lot of automatic and intelligent systems have been tested to predict failure or success in weaning or extubation. Among these, a variety of strategies to facilitate the separation or the release of the patient from MV, T-tube trials, continuous positive airway pressure (CPAP), pressure-support ventilation (PSV), synchronized intermittent mandatory ventilation (SIMV) and proportional assist ventilation (PAV) have been proposed.^{7–11} It has been previously demonstrated that weaning should be considered at early stages in patients under MV. It has been shown that the majority of patients can be successfully weaned at the first attempt and for this majority SBT is the major diagnostic test to determine if they can be successfully extubated. The initial SBT should last 30 min and consist of either T-tube breathing or low levels of PSV with or without 5 cm H₂O positive end expiratory pressure (PEEP); SIMV should be avoided as a weaning modality.^{1–11}

In the current issue of the Journal,¹² Gnanapandithan et al. have added further information that will improve our knowledge about the desirable "*Holy Grail*" for successful weaning. These authors have shown that weaning by gradual reduction of pressure support (PS) without initial SBT is associated with higher success rates, quicker weaning, and a shorter ICU stay vs. once a day PS-supported SBTs.

We also know that one of the major limitations for weaning-dedicated protocols is the impossibility of

making generalizations about different diseases and conditions: different diseases have different physio-pathological approaches and need different weaning protocols (WP).^{1,13}

A protocol for starting weaning or whether to decide the extubation time is mandatory. However, there is less evidence about the need for a strict protocol on how weaning is carried out in terms of modality and the time to be dedicated to each stage of weaning.¹ It is necessary to have WP to provide feedback for young doctors, for ICUs with a high turnover, in Operative Units with a rapid turn-over in expertise, for better integration of the different professionals who make up a weaning team and for more effective documenting of the clinical activity.¹

Whatever the explanation, it is important for us to highlight that in the weaning process, the method employed is probably less important than confidence and familiarity with the technique adopted, and that the same ventilatory approach may result in different outcomes depending on the underlying diseases.

The way to conduct weaning and patient's underlying conditions – rather than ventilator modality *per se* – may influence weaning outcomes as days of MV and percentage of success but will have no effect on survival. Also the potential role of NIV and synergic effect of cough assistance devices during weaning needs further clarification.

There are too many aspects that still have to be investigated. Therefore, the specific need for availability of clear WP is stressed and recommended. Future studies should define:

- (i) minimal criteria required for assessing the correct weaning time in view of diseases,
- (ii) the need for a screening test prior to SBT,
- (iii) identification of patients with successful SBT but who failed extubation,
- (iv) the role of CPAP/PEEP in COPD patients undergoing SBT,
- (v) the required duration of SBT in patients who failed the initial trial, and
- (vi) specific aspects of WP that resulted in improved weaning outcome.

We do not know if the magic formula of weaning will be ever *revealed* to doctors. Nevertheless, we are confident that this issue will remain the *Holy Grail* of continued research efforts. The quest for the Grail, by all of us involved in weaning, is a search for that indescribable uniqueness, *philosophical stone*. The ultimate quest for the highest knowledge can only be gained by courage and perseverance.

References

1. Nava S, Vitacca M. Chronic ventilator facilities. In: Martin T, editor. Principles and practice of mechanical ventilation. New York: McGraw-Hill; 2006. p. 691–704 [Chapter 33].
2. Carlet J, Artigas A, Bihari D, Durocher A, Hemmer M, Langer M, et al. The first European Consensus Conference in Intensive Care Medicine: introductory remarks. *Intensive Care Med.* 1992;18:180–1.
3. Halpern NA, Bettes L, Greenstein R. Federal and nationwide intensive care units and healthcare costs: 1986–1992. *Crit Care Med.* 1994;22:2001–7.
4. Epstein SK, Nevins ML, Chung J. Effect of unplanned extubation on outcome of mechanical ventilation. *Am J Respir Crit Care Med.* 2000;161:1912–6.
5. Bettese AJ, Perez M, Bak E, Rialp G, Mancebo J. A prospective study of unplanned endotracheal extubation in intensive care unit patients. *Crit Care Med.* 1998;26:1180–6.
6. Nevins ML, Chung J. Effect of unplanned extubation on outcome of mechanical ventilation. *Am J Respir Crit Care Med.* 2000;161:1912–6.
7. Vitacca M, Vianello A, Colombo D, Clini E, Porta R, Bianchi L, et al. Comparison of two methods for weaning patients with chronic obstructive pulmonary disease requiring mechanical ventilation for more than 15 days. *Am J Respir Crit Care Med.* 2001;164:225–30.
8. Esteban A, Alia I, Ibañez J, Benito S, Tobin MJ. Modes of mechanical ventilation and weaning. A national survey of Spanish hospitals. The Spanish Lung Failure Collaborative Group. *Chest.* 1994;106:1188–93.
9. Brochard L, Rauss A, Benito S, Conti G, Mancebo J, Rekik N, et al. Comparison of three methods of gradual withdrawal from ventilatory support during weaning from mechanical ventilation. *Am J Respir Crit Care Med.* 1994;150:896–903.
10. Esteban A, Frutos F, Tobin MJ, Alia I, Solsona JF, Valverde I, et al. A comparison of four methods of weaning patients from mechanical ventilation. *N Engl J Med.* 1995;332:345–50.
11. Esteban A, Alia I, Tobin MJ, Gil A, Gordo F, Vallverdu I, et al. Effect of spontaneous breathing trial duration on outcome of attempts to discontinue mechanical ventilation. *Am J Respir Crit Care Med.* 1999;159:512–8.
12. Gnanapandithan K, Aggarwal AN, Gupta D. Weaning by gradual pressure support (PS) reduction without an initial spontaneous breathing trial (SBT) versus PS-supported SBT: a pilot study. *Rev Port Pneumol.* 2011;17:242–3.
13. Bach JR, Gonçalves MR, Hamdani I, Winck JC. Extubation of patients with neuromuscular weakness: a new management paradigm. *Chest.* 2010;137:1033–9.

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