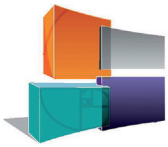
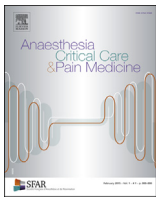
Anaesth Crit Care Pain Med 38 (2019) 429–430



SFAR
Société Française d'Anesthésie et de Réanimation



Editorial

# What is the most appropriate spontaneous breathing trial before extubation in ICU ventilated patients?

ARTICLE INFO

*Keywords:*
ICU
Invasive mechanical ventilation
Weaning

Mechanical ventilation, which is the most used organ replacement therapy in intensive care unit (ICU), is a life-saving intervention. In the ICU, the timing of liberation from invasive mechanical ventilation is an important issue for clinicians treating critically ill intubated patients receiving invasive mechanical ventilation [1–3]. After resolution of acute illness, or in other words when the resolution or improvement of the condition leading to intubation are done, mechanically ventilated patients are liberated from the ventilator, a process termed "weaning" from mechanical ventilation [4–6]. Weaning and extubation, though following each other in clinical practice, are two separate processes that pose distinct problems. Separating the ventilator from the patient (weaning) and removing the tracheal tube (extubation) are challenging issues [1]. Indeed, if the patient remains intubated too long, complications associated with prolonged invasive mechanical ventilation may appear [7]. On the other hand, if the patient is extubated too early, reintubation, which could occur in 5 to 25% of cases, is associated with higher morbidity and mortality [1–8].

Before extubation, it is recommended to perform a "weaning test", which consists of a "spontaneous breathing trial" (SBT) [5,9]. The SBT aims to evaluate how the critically ill patient is able to breath "alone" with no ventilatory assistance. In the standard of care, two main weaning tests are suggested for non-selected adult patients: a T-piece trial (oxygen supply without positive pressure) and low pressure support ventilation (PSV), with a low level of PSV without positive end expiratory pressure (PEEP), from 5 to 7 $cmH_2O$, to compensate for the imposed workload due to the endotracheal tube and ventilator circuit [5]. In case of presence of a heated and moisture exchanger, the low level of PSV set should take into account the imposed workload due to the additional dead space, which is evaluated from additional 2 to 5 cmH2O PSV level.

Although these two weaning tests are not equivalent in terms of work of breathing (WOB) [10], no study has yet assessed the risk of extubation failure. Therefore, both weaning trials are recommended to assess whether a patient is ready to be extubated [5,11]. Moreover, the duration of the weaning test is also a subject of controversy ranging from a "short" 30-minute to a "long" 120-minute period.

In a recent Spanish clinical trial, Subira et al. [12] compared two different SBT techniques in 1153 mechanically ventilated patients in 18 ICUs. One was a "long" 120 minutes T-piece SBT ("highly demanding") and the other was a "short" 30 minutes low-PSV SBT ("less demanding"). In both groups, patients who successfully completed their SBT were extubated. The authors reported that patients in the 30 minutes low-PSV SBT group were more likely to be extubated compared to patients in the 120 minutes T-piece SBT group. Successful extubation occurred in 82% of patients in the low-PSV group and in 74% of patients in the T-piece group ($P = 0.001$). Worthy of note is that patients in the PSV SBT group did not experience a significant higher reintubation rate in the 72 hours after extubation (11% vs. 12%, $P = 0.63$). No significant difference was shown for ICU length of stay (median 9 days *vs.* 10 days; $P = 0.69$) or hospital length of stay (median 24 days *vs.* 24 days ($P = 0.45$). In comparison with patients in the T-piece group, those in the low-PSV group had significantly lower hospital mortality (10% *vs.* 15% [$P = 0.02$]) and 90-day mortality (13% *vs.* 17% [$P = 0.04$]).

The authors [12] should be congratulated for performing the largest randomised clinical trial ever conducted comparing the two common SBT techniques (T-piece *vs.* low PSV). They add a new piece to the puzzle of the weaning process in the overall non-selected patients. Their findings suggest that most patients can be tested for a short 30-minute period using a so-called "low-PSV" level of 8-cmH2O and zero PEEP. Moreover, using the low-PSV SBT add a safety process as the patient is continuously monitored for the main physiological respiratory variables (respiratory rate, tidal volume, minute ventilation. . .).

Future research should evaluate which additional prophylactic strategies could be associated to the optimal SBT, with the aim to increase the success rate of extubation [13]. It could be proposed to evaluate:

https://doi.org/10.1016/j.accpm.2019.09.005

- the optimal analgesia-sedation protocol as the weaning process of both analgesia-sedation and ventilator weaning are always linked [7];
- the use of reconnection to ventilator before extubation that was associated with reduced reintubation rate at 48 hours in a recent study [14] (reconnection to ventilator was made in 25% of included patients in the Subira study [12]);
- prophylactic non-invasive ventilation after extubation [15,16] (prophylactic non-invasive ventilation was performed in 9% of the low-PSV group and in 6% of the T-piece group in the Subira study [12]);
- the use of prophylactic high-flow nasal oxygen cannula after extubation [17–19] (which was made in 16% of the low-PSV group and in 13% of the T-piece group in the Subira study [12]).

In summary, the Subira study [12] suggests that for the majority of "easy to wean patients", a short 30-minute period using a so-called "low-PSV" level of 8-cmH2O and zero PEEP could be proposed as first line approach before extubation as SBT test.

### Disclosure of interest

Pr. Jaber reports receiving consulting fees from Drager, Fisher & Paykel and Fresenius. The other authors declare that they have no competing interest.

## References


[1] Jaber S, Quintard H, Cinotti R, Asehnoune K, Arnal JM, Guitton C, et al. Risk factors and outcomes for airway failure versus non-airway failure in the intensive care unit: a multicenter observational study of 1514 extubation procedures. Crit Care 2018;22(1):236.

[2] Mauri T, Grasselli G, Jaber S. Respiratory support after extubation: noninvasive ventilation or high-flow nasal cannula, as appropriate. Ann Intensive Care 2017;7(1):52.

[3] De Jong A, Jaber S. Focus on ventilation management. Intensive Care Med 2018;44(12):2254–6.

[4] Esteban A, Ferguson ND, Meade MO, Frutos-Vivar F, Apezteguia C, Brochard L, et al. Evolution of mechanical ventilation in response to clinical research. Am J Respir Crit Care Med 2008;177(2):170–7.

[5] Girard TD, Alhazzani W, Kress JP, Ouellette DR, Schmidt GA, Truwit JD, et al. An Official American Thoracic Society/American College of Chest Physicians Clinical Practice Guideline: Liberation from Mechanical Ventilation in Critically Ill Adults. Rehabilitation Protocols. Ventilator Liberation Protocols, and Cuff Leak Tests. Am J Respir Crit Care Med 2016.

[6] Boles JM, Bion J, Connors A, Herridge M, Marsh B, Melot C, et al. Weaning from mechanical ventilation. Eur Respir J 2007;29(5):1033–56.

[7] Chanques G, Conseil M, Roger C, Constantin JM, Prades A, Carr J, et al. Immediate interruption of sedation compared with usual sedation care in critically ill postoperative patients (SOS-Ventilation): a randomised, parallel-group clinical trial. Lancet Respir Med 2017;5(10):795–805.

[8] Epstein SK, Ciubotaru RL, Wong JB. Effect of failed extubation on the outcome of mechanical ventilation. Chest 1997;112(1):186–92.

[9] Pepin JL, Timsit JF, Tamisier R, Borel JC, Levy P, Jaber S. Prevention and care of respiratory failure in obese patients. Lancet Respir Med 2016;4(5):407–18.

[10] Mahul M, Jung B, Galia F, Molinari N, de Jong A, Coisel Y, et al. Spontaneous breathing trial and post-extubation work of breathing in morbidly obese critically ill patients. Crit Care 2016;20(1):346.

[11] Quintard H, l'Her E, Pottecher J, Adnet F, Constantin JM, De Jong A, et al. Intubation and extubation of the ICU patient. Anaesth Crit Care Pain Med 2017;36(5):327–41.

[12] Subira C, Hernandez G, Vazquez A, Rodriguez-Garcia R, Gonzalez-Castro A, Garcia C, et al. Effect of pressure support vs t-piece ventilation strategies during spontaneous breathing trials on successful extubation among patients receiving mechanical ventilation: a Randomized Clinical Trial. JAMA 2019;321(22):2175–82.

[13] Asehnoune K, Mrozek S, Perrigault PF, Seguin P, Dahyot-Fizelier C, Lasocki S, et al. A multi-faceted strategy to reduce ventilation-associated mortality in brain-injured patients. The BI-VILI project: a nationwide quality improvement project. Intensive Care Med 2017;43(7):957–70.

[14] Fernandez MM, Gonzalez-Castro A, Magret M, Bouza MT, Ibanez M, Garcia C, et al. Reconnection to mechanical ventilation for 1 h after a successful spontaneous breathing trial reduces reintubation in critically ill patients: a multicenter randomized controlled trial. Intensive Care Med 2017;43(11):1660–7.

[15] Yeung J, Couper K, Ryan EG, Gates S, Hart N, Perkins GD. Non-invasive ventilation as a strategy for weaning from invasive mechanical ventilation: a systematic review and Bayesian meta-analysis. Intensive Care Med 2018;44(12):2192–204.

[16] Vaschetto R, Longhini F, Persona P, Ori C, Stefani G, Liu S, et al. Early extubation followed by immediate noninvasive ventilation vs. standard extubation in hypoxemic patients: a randomized clinical trial. Intensive Care Med 2019;45(1):62–71.

[17] Jaber S, Bellani G, Blanch L, Demoule A, Esteban A, Gattinoni L, et al. The intensive care medicine research agenda for airways, invasive and noninvasive mechanical ventilation. Intensive Care Medicine 2017;43(9):1352–65.

[18] Zhu Y, Yin H, Zhang R, Ye X, Wei J. High-flow nasal cannula oxygen therapy versus conventional oxygen therapy in patients after planned extubation: a systematic review and meta-analysis. Crit Care 2019;23(1):180.

[19] Hernandez G, Vaquero C, Colinas L, Cuena R, Gonzalez P, Canabal A, et al. Effect of postextubation high-flow nasal cannula vs noninvasive ventilation on reintubation and postextubation respiratory failure in high-risk patients: a randomized clinical trial. JAMA 2016;316(15):1565–74.



Audrey De Jong[a,b], Mathieu Capdevila[a,b], Gerald Chanques[a,b], Laure Cazenave[c,d], Samir Jaber[a,b,*]

[a]*Inserm U1046, CNRS UMR 9214, anaesthesiology and intensive care, anaesthesia and critical care department B, Saint Eloi Teaching hospital, PhyMedExp, university of Montpellier, 34295 Montpellier cedex 5, France*

[b]*Centre hospitalier universitaire Montpellier, 34295 Montpellier, France*

[c]*Department of anaesthesia and critical care, Hospices Civils de Lyon, Lyon, France*

[d]*Groupe Jeunes, Société française d'anesthésie et de réanimation (SFAR), 74, rue Raynouard, 75016 Paris, France*

*Corresponding author. Anaesthesia and critical care department, Saint Eloi Teaching hospital, Intensive Care Unit, university Montpellier 1, 80, avenue Augustin-Fliche, 34295 Montpellier cedex 5, France

*E-mail address:* s-jaber@chu-montpellier.fr (S. Jaber).