QUEL TEST POUR L’EXTUBATION? LA PIÈCE EN T

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The T-piece trial is one of the methods used for weaning the patients from mechanical ventilation. Once a patient is intubated and supported by a ventilator, we buy time to recover from the disease causing the need for artificial support. From a general point of view, patients receive invasive ventilatory support because of gas exchange troubles and/or the inability to sustain the high workload due to spontaneous breathing. If the decision to intubate has not been delayed, so it is the decision to extubate. Actually, the main goal to achieve once mechanical ventilation has been initiated, is to withdraw the ventilator as soon as possible and to avoid the reintubation of the trachea.

To reach this end (withdrawing the ventilator and extubation), patients need to be clinically evaluated very often, at least once per day. Such decision is based on clinical grounds (amelioration of gas exchange and lung mechanics abnormalities, hemodynamic stability, and adequate neurological status with a reasonable likelihood of protecting the upper airways). To fulfill this goal, clinicians proceed with disconnection from the ventilator and let the patients to breathe spontaneously through a T-piece (with added oxygen if necessary).

The T-piece technique is very useful because it allows to screen the patients immediately post-disconnection, by using the so-called rapid and shallow breathing index ([1]), and it also allows to clinically evaluate the patient while he/she breathes spontaneously before the decision to extubate is taken. The screening phase essentially consists in measuring the respiratory rate and the tidal volume immediately after disconnection from the ventilator (usually within 3 minutes). Such screening, and using the ratio f/Vt 100 (breaths/min/L) or below, allows to pick up patients who are most likely to breath early in the course of the disease; such very sensitive test (few patients with a f/Vt ratio above 100 can actually breath without assistance) is not sufficient to guarantee that a particular patient can breath on his/her own without assistance ([2]). To confirm the latter, a variable period (as short as 30 min or as long as 2 hours) of spontaneous breathing is allowed. Importantly, the usefulness of this test (ratio f/Vt) depends on the pretest probability of success: if there is not clinical uncertainty regarding the success or failure when a clinician screens the patients, the test is totally useless ([2, 3]). During the 30-120 min period, close monitoring of clinical signs and symptoms of distress is necessary since this provides a highly specific clue as to the decision to extubate (i.e. a good clinical tolerance will confirm that indeed the patient can breathe by his/her own and the failure rate will be acceptably low).

The fundamental importance of an observation, confirmatory, period of spontaneous breathing after passing the screening phase was provided by Zeggwagh et al ([4]). These authors studied a group of 101 patients who were extubated after only 2 min of a spontaneous breathing trial and, 37% needed reintubation within 48h, a rate much higher than the usually reported (below 20%). The optimal duration of such a confirmatory test is not precisely known. Esteban et al ([5]) compared the outcomes of spontaneous breathing trials lasting 30 and 120 min. in two randomly assigned groups of 270 and 256 patients respectively. The successful extubation and the reintubation rates were similar in the two groups: 76% (n=205) and 13% (n=32) respectively in the 30 min group, and 73% (n=187) and 13% (n=29) respectively in the 120 min group. The authors concluded that a 30 min trial is as effective as trial of 120 min. These data, however, is not fully supported by results from other groups ([6]), who found that a relevant number of patients will fail the trial
before 120 min and well after the initial 30 min: in this study, 25 out of 69 patients (36%) who did not pass a T-piece trial, failed between 30 at 120 min after the trial had started. In addition, Esteban’s data is not easy to interpret since the two groups (30 and 120 min) had totally different median times to failure: 15 min and 30 min respectively. Had the two groups be identically screened and managed, such difference would not have been observed. In other words, there are at least 50% of patients who will fail after 30 min or a higher reintubation rate is to be expected with only 30 min.

Some authors have used the 2h T-piece trial confirmatory test as equivalent to low levels of pressure support. The rationale for using this low level of support is based in part on data provided by Brochard et al ([7]). These authors showed that the work of breathing through a T-piece was, on average, 27% higher than after extubation. This was mainly due to a decreased minute ventilation after extubation, and the authors showed that the level of pressure support that reduced the work of breathing to its post-extubation value ranged from 3 to 14 cmH2O, depending on individual patients (higher levels were required in patients with chronic obstructive pulmonary disease). Esteban et al ([8]) compared the outcomes of spontaneous breathing trials with a T-piece or low levels of pressure support (7 cmH2O), both during 120 min. In a multicenter trial, the authors randomized 246 patients to the T-piece and 238 patients to pressure support. The successfully extubated and reintubated patients did not differ between groups: 156 (63%) and 36 (18%) respectively in the T-piece group and 167 (70%) and 38 (18%) in the pressure support group. However, the percentage of patients failing the trial was significantly (P=0.03) higher when T-piece was used (22%, 54/246) as compared to pressure support (14%, 33/238).

The fact that the percentage of patients who failed a T-piece trial was much higher as compared to relatively low levels of pressure support in Esteban’s study ([8]), is not surprising. The seminal clinical research on the physiologic effects of pressure support at 10, 15 and 20 cmH2O performed by Brochard and coworkers ([9, 10]) clearly show that, in comparison with spontaneous unassisted breathing, pressure support leads to major modifications in breathing pattern and work of breathing. With levels as low as 10 cmH2O, pressure support significantly increases tidal volume and significantly decreases both, respiratory rate and inspiratory muscle effort. These findings are extremely consistent for pressure support, not only in chronic obstructive disease patients, but also in patients having other causes of respiratory failure.

On clinical grounds, however, one may wonder whether the presence of an endotracheal tube (which indeed poses an additional resistive load to be overcome) is a real ventilatory challenge as compared to the resistive properties of the natural upper airway after a successful extubation. This question was addressed by Straus and colleagues ([11]) in a group of 14 patients who were successfully extubated. These patients were studied at the beginning of a 2 hours T-piece trial, at the end of this trial, and immediately after extubation. The indexes of inspiratory muscle effort (pressure time product and work of breathing), did not differ among the three situations they studied and the original diameter of the endotracheal tube had no influence (i.e., the results did not change when patients with endotracheal tubes below 8 mm were compared to those who had been intubated with tubes of 8 mm or bigger). The authors concluded that in successfully extubated patients, removal of the endotracheal tube does not alter the patient’s work of breathing and that a 2
The clinical relevance of evaluating patients under low levels of support (pressure support 5 and CPAP 5 cmH2O) or a T-piece has been recently shown by El-Katib and coworkers ([12]). These authors studied a group of 36 patients who had an acute respiratory failure (none of them had a chronic obstructive pulmonary disease). The ratio f/Vt was measured under CPAP 5 plus pressure support 5 cmH2O, CPAP 5 , and T-piece. The f/Vt measurement was done when patients were deemed to be ready for extubation, after an average duration of mechanical ventilation of 8.7 days. All patients had a ratio f/Vt below 105 breaths/min/L during pressure support and CPAP alone, but 13 of them (36%) had a ratio f/Vt above 105 breaths/min/L during the T-piece trial. The 23 patients who had a ratio f/Vt below 105 were successfully extubated and did not need reintubation. Among the 13 patients with a ratio f/Vt above 105, 3 were extubated and all of them needed reintubation.

Finally, Vitacca et al ([13]) studied difficult to wean patients with a chronic obstructive pulmonary disease. They compared the outcomes of two weaning strategies (T-piece and pressure support) in 52 subjects who had been ventilated for more than 15 days and failed an initial T-piece trial performed on the admission at a specialized weaning center. The outcomes at 30 days did not differ between the modes. The success and failure rates were, respectively, 19/26 (73%) and 7/26 (27%) for pressure support and 20/26 (77%) and 6/26 (23%) for the T-piece method.

In conclusion, the T-piece trial is an extremely useful approach to screen patients under mechanical ventilation when they are clinically likely to breath without assistance and it is also crucial to confirm that these patients can be successfully weaned when a the 2h confirmatory test is performed during spontaneous unassisted breathing. Using pressure support to evaluate weanability, because its effects on breathing pattern and respiratory muscle effort, can mislead clinicians in their evaluation of the tolerance to spontaneous unassisted breathing.

REFERENCES:


