Commentary

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Accelerating Weaning in Tracheostomized Critically-Ill Patients: Increasing Effective Airway Diameter

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Mechanical ventilation (MV) is the main supportive treatment in patients with acute respiratory failure in Intensive Care Units, but most efforts are intended to restore spontaneous ventilation again, up to 40% of total time under MV [1] (Epstein). Even so, close to 30% of patients become dependent on MV for prolonged weaning ventilation, according to the most recent series [2]. Tracheostomy is frequently used in this subgroup of patients, as it improve patient comfort and communication, reduce sedative use and make easier airway management, but little evidence supports clinical decision making for weaning these patients [3].

A study by Bach et al. [4] found benefit when deflating the tracheal cuff in severe chronic neuromuscular patients, with minimal ventilatory reserve and intermittently dependent on MV, in terms of achieving a higher rate of weaning. Additional studies showed that further increments in the useful airway diameter (e.g. a fenestrated cannula) are important at the time of deflating the cuff, because this decreases the air resistance and the suction pressure required to move the air [5]. In addition, a previous study from our group [6] also supported these results after finding higher values for peak expiratory flow and forced vital capacity when measured while the cuff is deflated.

Scarce literature is focused on this topic for general critically ill patients. A recent trial by Jubran et al. [7] reported a reduced weaning time when using a protocol based on increasing disconnections from MV instead of progressive reduction of the ventilatory support. We intended to provide a new tool to further improve the weaning of tracheostomized general critically ill population, by modifying MV disconnection strategies [8].

Deflating the tracheal cuff is somehow an intermediate step not only to wean but also to decannulate the patient. Deflating the cuff impedes isolation of the lower airway, theoretically facilitating micro-aspirations and finally respiratory infections. Swallowing function is closely related to this risk and should always be evaluated before deflating the cuff. Considering that patient's collaboration is fundamental to perform the tests included in the decannulation protocols, we excluded from our population neuro-critical patients with deterioration of the level of consciousness, as they are the group at the highest risk for not tolerating decannulation [9].

Patients were randomized to one of the two groups: the one with the highest effective airway diameter (including the deflated cuff, a fenestrated cannula with a 7 mm inner diameter and inner sleeve), and the conventional group with the original cannula (8 mm inner diameter and inner sleeve) maintained and with the cuff inflated.

In our study, more than 50% of the patients had the tracheostomy indicated because of prolonged MV. Although the two groups were adequately balanced, there was a better baseline swallowing function that could bias a false positive benefit in the experimental group in terms of the final swallowing function and a longer period from tracheostomy to the first disconnection from MV in the deflated group that could bias a false negative reduction in the weaning time.

Weaning time was 5 days shorter in the deflated group and fewer patients in the deflated group developed respiratory infections (15% less), both of them with significant statistical difference. In the deflated group, swallowing was better and improved more from baseline. We observed a trend toward lower weaning failure in the deflated group. Decannulation failure, defined as the need for a new cannula after protocolized decannulation, was 1% in the inflated group *vs.* 3% in the deflated group, but all patients with decannulation failure were eventually decannulated in the wards. It is worth notice that, in our study, the ventilator disconnection greater than 24 h was considered successful in weaning. Although it is possible to suppose that it is too short a period of time for patients with prolonged weaning, this does not invalidate the results considering that follow up was long enough to assure patients remained MV-free at ICU discharge.

As it becomes evident, all survivors returned to spontaneous breathing, not being necessary for any patient to be transferred to a center for chronic patients. This percentage is visibly superior to that of the study by Terragni et al. [10] in their multicentric study, where it reported a 68% success. This discrepancy can be explained by several factors. The most important is the exclusion of patients with extremely low probability of success at weaning. In addition, monitoring these patients in an ICU during weaning may allow a greater success rate. Finally, the use of a weaning protocol including an increase in the airway diameter has proven clinical benefit in our study. We want to emphasize that our protocol includes conditioning the air to all tracheostomized patients after they are disconnected from MV [11].

The most common clinical condition related to deflation was coughing, sometimes intense, but always selflimited. Food aspiration under oral intake after weaning from MV was observed in a really low number of patients (less than 10%). Enteral feeding is the solution for these patients, as only one patient had an anatomical dysfunction needing to have the cuff reinflated.

The multivariate analysis confirmed that deflating the cuff is independently associated with a reduced weaning time and a decrease in respiratory infections.

The lowest rate of pneumonia is found in the study by Rumbak et al. [12] in the group of early tracheostomy (5% in patients under MV for less than 7 days). Even so, the infection rate in our control group (14% in a population under MV for 27 days) is lower than in other studies, ranging from 18% to 25% (mean time of MV 15 to 17 days) [13,14]. Although the mechanism is unclear and there are some factors that may be related to it, in our opinion the use of high flow oxygen therapy may play a pivotal role: on the one hand its CPAP effect, which theoretically reduces the risk of microaspirations and, on the other hand, with the cuff deflated, the high flow in the peri-cannula space could allow a better drainage of the secretions. In addition, the improvement in swallowing function associated with balloon deflation can help reduce microaspirations. However, as infection episodes analysed are those that appeared after randomization, the percentage is lower than those reported elsewhere [13,14].

With the present data, we consider that the implementation of this measure is cheap and useful in clinical practice. Another outstanding point of our protocol, is that after patients are definitively disconnected from MV, the only criteria pending to be fulfilled for decannulation is suctioning needs, which is in line with the next trial performed by our group (REDECAP trial, Clinicaltrials.gov Identifier: NCT02512744).

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