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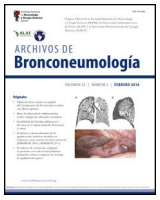

Editorial

Weaning From Mechanical Ventilation in Chronic Critically Ill Patients

Chronic critically ill patients are characterized by prolonged stays in the ICU and provoked by prolonged necessity of organ support. Except for renal, selected cases of cardiac failure and hypercapnic respiratory failure, other prolonged organ failures necessarily lead to recovery, response to treatment or death, including hypoxemic respiratory failure. This is mainly caused by the safety profile of organ support devices these patients need (e.g. haemodialysis, long-term implantable cardiac assist devices or noninvasive ventilation), making possible their chronic clinical management in step-down units, general wards or home.

Thus, a chronic critically ill patient mainly comes from dependency on invasive mechanical ventilation after recovery of the initial injury, irrespective of the damaged organ. This dependency is secondary to the ICU-acquired syndrome, especially muscular weakness and neurological impairment including delirium.

Invasive mechanical ventilation is defined for patients being ventilated directly into the trachea. Although tracheostomies were initially designed to avoid airway injury secondary to prolonged harmful orotracheal tubes, technological improvements have modified its indications to other meaningful clinical outcomes, including comfort, reduced need for sedatives, risk for developing a ventilator-associated respiratory infection, facilitating mobilization and communication, and reduced training needed for health-care workers and relatives. Tracheostomy can be considered a support device for patients with airway failure, as it is associated with increased mortality under some clinical conditions. Its intermediate safety profile has generated difficulties in deciding where to manage tracheostomized patients. On the one hand patients liberated from mechanical ventilation with persistent airway failure for neurological impairment, inability to deal with respiratory secretions, swallowing dysfunction or airway patency problems have increased risk for death when discharged to general wards[1]; on the other hand, tracheostomy facilitate clinical protocols including disconnections from mechanical ventilation,[2] first line approach to wean these patients. This generates partial dependence on the ventilator, opening the room for management at respiratory step-down units.

In addition, related extra-pulmonary clinical impairment (immunosuppression, cognitive dysfunction, malnutrition, neuromuscular alterations, impaired wound healing, etc.) usually make frailty incompletely recovered, further limiting discharge to general wards.[3]

It is expected an increase in the number of chronic critically ill patients: it is well-established that early tracheostomy reduce weaning time. However, it has been recently reported a benefit in reducing the number of ventilator-associated pneumonias, allowing to reduce the time on total ventilator support, further shortening ICU stay, increasing ventilator-free days, and lowering mortality.[4] During the COVID-19 pandemic, it was also observed that early tracheostomy could be used for ICU occupancy management by shortening hospital stay.[5]

Therefore, health care systems should plan the creation of more respiratory step-down units, where multidisciplinary teams could facilitate a multimodal approach.

These specialized units should include personal trained for specific management necessities focused on weaning from mechanical ventilation, decannulation of the tracheostomy, but also involving airway and nutritional management, rehabilitation, psychological support, speech therapy, etc.[6] Briefly, these skills can be summarized as follows.

First, focusing on weaning from mechanical ventilation, clinical expertise is needed to early detect time to start weaning attempts.[2] The use of protocols including progressive decrease in ventilator support result in delayed weaning compared to progressive spontaneous breathing trials in most patients.[2] In addition, it is also important to early detect cases with specific respiratory clinical conditions affecting very difficult to wean patients and limiting the application of standard protocols (e.g. proximal or distal airway malacia), which merit development of different weaning protocols.

Second the airway management: knowledge of available material for tracheal cannulation deserve special mention. Some modifications of tracheal cannulas facilitate prolonging periods of spontaneous breathing (e.g. fenestrated tracheostomy tubes, cannulas with a smaller internal diameter, deflating the cuff). Increasing the effective airway diameter not only reduces weaning time, but decreases respiratory infection rates, and shortens ICU stays.[7]

Third, spontaneous breathing through the tracheostomy should be accompanied by humidified and heated oxygen,[8] as this reduces the need for suctioning and improves mucociliary function. To achieve this airway conditioning, high-flow oxygen should be administered via the trachea, with flow rates of at least 50 L per minute and a temperature of 37 °C.[9] Although this does not reduce the work of breathing,[10] it does improve oxygenation and respiratory rate.[9]

Fourth, decannulation should always be considered, even before definitive weaning from the ventilator is achieved. Additional requirements need attention: the indication for the tracheostomy has to been resolved, the patient has an adequate level of consciousness and laryngopharyngeal function, based on evaluation of airway patency, phonation and swallowing functions.[11] Screening of airway obstruction can be performed with a clinical test to ensure airway patency with a rapid occlusion test. The tube is occluded for 5 min or less, and the patient's ability to phonate is checked as well as any sign of respiratory insufficiency or stridor. If this

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test fails, an endoscopic evaluation of the entire airway should be conducted to assess the glottis and subglottic areas for anatomical and functional abnormalities.[8] This test should be performed by highly experienced airway endoscope specialist. Finally, the last step in decannulation evaluation should include the assessment of patient's ability to manage secretions. Traditionally prolonged capping trials were required to evaluate the patient's pharyngolaryngeal function and respiratory secretions management before decannulation (e.g. 24–72 h).[8,11] However, this method has been shown to delay the entire process,[12] in part because validated objective monitoring of cough efficacy is lacking beyond degenerative neuromuscular diseases.[13] The whole secretion management can be monitored by the number of suctioning procedures needed, as secretions production and cough strength cannot be measured separately. The lower the aspiration requirements including the night period, the greater the chance to successful decannulation, allowing for a personalized approach. This has been shown to decrease the incidence of respiratory infections and reduce the time to decannulation without increasing the failure rate or the need for recannulation.

Fifth, during the weaning period, the patient should undergo multimodal rehabilitation throughout the entire process, which includes physiotherapy, dysphagia assessment and rehabilitation, cognitive therapy, psychological support, and family involvement in care, among others.[6] Respiratory rehabilitation should be implemented separately from torso and limbs rehabilitation by dedicated teams. In this regard, mechanical cough assistants are being increasingly introduced in these units. These devices provide positive pressure followed by a rapid change to negative pressure, simulating what happens during a normal cough, thus helping the patient mobilize secretions during rehabilitation. Ongoing research will provide details on personalized settings and additional indications.[14,15]

Sixth, few is known in benchmarking on best quality management in tracheostomized patients. It has been generally accepted that decannulation failure rate should be around 2.5–5%,[8,11] but this assumption comes from the unreal homogenization of this population. Different subgroups awaits for redefinition, according to mid and long-term prognosis and real capability of functional recovery. Therapeutic effort limitation in these patients needs further research to avoid wasting the limited health care resources.

Different options for respiratory step-down units have been described.[16] However, selection of optimal design and resources allocation should be tailored according to local practices and hospital conditions.

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Conflict of Interest

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