Obtained measurements of respiratory parameters in the April issue of CHEST.1 A simple, reliable, discriminating parameter continues to elude us. The focus has been directed at determining which variables indicate a reduction in ventilatory support or successful 2-h spontaneous breathing trial (SBT) with or without subsequent discontinuation of mechanical ventilation (DOMV). Pulmonary mechanics have been measured prior to reducing ventilatory support or initiating an SBT as well as trended during an SBT. The study by Martinez et al2 in the April issue of CHEST provides a fresh approach. It trends basic measurements of pulmonary mechanics over the resumption of ventilatory support after a 2-h SBT.

This study employed easily applicable criteria in determining the readiness of a patient to initiate the weaning process as well as defining lack of response to an SBT. These criteria have been adopted by the American College of Critical Care Medicine.3 Martinez et al2 obtained measurements of respiratory parameters (ie, minute ventilation [VE], respiratory rate [RR], and rapid shallow breathing index [RBSI]) or the frequency/tidal volume ratio, in patients ready for weaning over a baseline period, at the end of a SBT and during the period of reinstitution of mechanical ventilation. The focus was on determining the amount of time needed for VE to return to baseline after the resumption of ventilatory support. However, changes in baseline parameters at the completion of the SBT also were assessed. In this study, baseline measurements were obtained during a relatively passive time in the preceding 24 h and not at the onset of an SBT. The measurement of RR, RBSI, and VE were obtained from a commercially available ventilator-interfacing module that permitted rapid assessment and trending. The authors then examined the capabilities of RBSI, RR, and VE recovery time to successfully predict extubation after the final SBT.

Sixty-nine patients were enrolled into the study from a community hospital medical-surgical ICU. Discontinuation of mechanical ventilation was successful in 59 patients (85.5%). For the 10 patients who were reintubated within 7 days, the mean (± SD) time to reintubation was 2.5 ± 2.6 days. The duration of mechanical ventilation averaged 3.5 and 4.4 days, respectively, for the successful and nonresponding groups. When examining the parameters outlined above in those for whom extubation was successful, the authors noted that VE recovery time outperformed RR (cutoff, 38 breaths/min) and RBSI (cutoff, 105 breaths/min/L). Those patients who were successfully extubated had a mean VE recovery time of 3.6 ± 2.7 min, compared to 9.6 ± 5.8 min (p < 0.011) for those needing to be reintubated. Baseline RBSI was elevated in the group needing to be reintubated (p < 0.01). VE and RR were increased from baseline after the SBT, and tidal volume was reduced. The area under the receiver operating curves for the prediction of extubation outcome was 0.85 for VE recovery time, while it was only 0.57 for post-SBT RBSI.

The authors2 concluded that VE recovery time may help to determine respiratory reserve and be valuable in predicting the success of extubation.

Clinicians often follow a checklist to assess readiness for weaning and the likelihood of succeeding, although generally not systematically as suggested by the weaning assessment program of Burns et al.4 Clinicians assess respiratory mechanics prior to and during an SBT when predicting successful DOMV. Parameters commonly examined prior to an SBT include the RBSI, negative inspiratory pressure (NIP), respiratory drive (P0.1), inspiratory muscle pressure generated, P0.1/NIP ratio, inspiratory muscle pressure/NIP ratio, VE, RR, spontaneous tidal volume, work of breathing, pressure-time product, wean index, CROP (ie, compliance, respiratory rate, oxygenation, and pressure), and dead space ratio.1,3,5
Variables trended over an SBT include RR, tidal volume, oxygen cost of breathing, oxygenation, RBSI, and NIP.1,3,5 Predictions from these parameters were encouraging at first, but a rigorous analysis by Meade et al demonstrated that the present cadre of parameters was indiscriminant. Both the RBSI (threshold, 105 breaths/min/L) and RR (threshold, 38 breaths/min) performed well but were of limited value. The likelihood ratios for RBSI and RR in predicting successful extubation were 1.58 and 1.50, respectively. The likelihood ratios for failure were 0.22 and 0.23, respectively. The sensitivities and specificities for the two were 0.92 and 0.93, respectively, and 0.45 and 0.47, respectively. The best predictor was the P0.1/maximal inspiratory pressure ratio, with likelihood ratios for success and failure of 16.3 and 0.15, respectively, and those for sensitivity and specificity of 0.69 and 0.96, respectively.

Much attention has been devoted to patient performance during an SBT as being predictive of successful DOMV. Several studies6–8 have validated a 2-h trial as capable of predicting success for DOMV. Most patients fail an SBT within the first hour. Esteban et al9 evaluated success at 30 min on the initial SBT, and found similar success and failure rates with regard to DOMV. However, Valverdu et al8 noted that almost one quarter of patients who failed to respond to an SBT did so after 60 min, which raises an issue with the 30-min trial. Vitacca et al10 examined patients with COPD who had received mechanical ventilation for ≥15 days and noted that 60% failed T-piece trials after a median of 120 min. It appears that a successful 2-h SBT for patients requiring prolonged mechanical ventilation may not be sufficient to predict successful DOMV. VE recovery time has potential as a predictor of success during mechanical ventilation in patients requiring short-term and long-term mechanical ventilation. It provides additional data beyond the 2-h SBT and may serve as an assessment of a patient’s endurance and reserve.

As with many initial studies, the number of patients evaluated in the study by Martinez et al2 was small, as was the number of patients requiring prolonged mechanical ventilation. Although the study took place at one center, its simplicity makes this highly applicable to other settings. As 75% of patients did not require extensive weaning protocols, future studies should be restricted to those patients requiring >3 days of mechanical ventilation. Indeed, in the study by Martinez et al,2 the mean duration of mechanical ventilation was approximately 4 days, but the median was not expressed in the publication. If the tool is robust, then it should perform well for patients receiving longer durations of mechanical ventilation. Larger studies may allow one to address trends in recovery time during the patient’s hospital course and to evaluate the value of interventions that are directed at liberating the patient from mechanical ventilation.

In summary, a new and simple assessment tool, widely applicable, has been put forth. The initial results are encouraging but do not provide a threshold for discrimination between success and failure with regard to the discontinuation of mechanical ventilation, and the study has been performed in a small study population. Larger validation studies are needed and should be inclusive of multiple patient populations and restricted to those patients with a duration of mechanical ventilation exceeding 3 days.

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