



Changes in practice for mechanically ventilated patients: effect of the pain, agitation, and delirium guidelines

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Mechanical ventilation is an essential intervention in critically ill patients who need respiratory support. However, inappropriate parameters (e.g., excessively high peak pressure and tidal volume, and patient-ventilator dys-synchrony) in patients with invasive mechanical ventilation may prolong mechanical ventilation and are associated with high morbidity and mortality [1]. Thus, clinical practice is aimed at reducing the need for prolonged mechanical ventilation [2,3].

Esteban et al. [4] have conducted international cohort studies every 6 years since 1998 to evaluate the general characteristics, treatment-related variables, and clinical outcomes of patients who have received mechanical ventilation and to assess changes in mortality over time. In prospective cohort studies conducted in 1998, 2004, and 2010, the use of non-invasive positive-pressure ventilation was increased (5% in 1998 vs. 14% in 2010), tidal volume was decreased (mean 8.8 mL/kg actual body weight in 1998 vs. 6.9 mL/kg in 2010), and positive end-expiratory pressure (PEEP) was increased (4.2 cm H₂O in 1998 vs. 7.0 cm H₂O in 2010). The crude mortality rate in the intensive care unit (ICU) was lower in 2010 compared with 1998 (28% vs. 31%; odds ratio

[OR], 0.78; 95% confidence interval, 0.67 to 0.92) after adjusting for baseline and management variables.

Penuelas et al. [5] reported changes in the epidemiology of mechanical ventilation in Spain from 1998 to 2016. Volume-controlled ventilation (VCV) was the most commonly used mode, followed by support pressure and pressure-regulated VCV. A decrease in tidal volume (9 mL/kg in 1998 and 6.6 mL/kg in 2016; $p < 0.001$) and an increase in PEEP (3 cm H₂O in 1998 and 6 cm H₂O in 2016; $p < 0.001$) were observed. Frutos-Vivar et al. [6] evaluated the disconnection of mechanical ventilation in the same Spanish cohort. There was a significant increase ($p < 0.001$) in the rate of gradual reduction in support pressure as a weaning trial. The adjusted probability of using the gradual reduction in pressure support versus a spontaneous breathing trial (SBT) increased over time (with 1998 as a reference: OR, 0.99 in 2004, 0.57 in 2010, and 2.43 in 2016) for the first attempt at disconnection, while ventilation duration dedicated to weaning decreased (45% in 1998 vs. 36% in 2016).

In this issue of the *Korean Journal of Internal Medicine*, Sim et al. [7] report changes in the management and outcomes of patients undergoing mechanical ventilation in South Korea based on the

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cohorts evaluated in their 2010 and 2016 studies. In total, 226 patients from 18 ICUs and 275 patients from 12 ICUs receiving invasive mechanical ventilation for more than 12 hours or non-invasive ventilation for more than 1 hour in a 1-month period were enrolled in 2016 and 2010, respectively. Pressure-controlled ventilation (PCV) was the most common mode in both groups. The initial tidal volume (7.1 mL/kg vs. 7.4 mL/kg, $p = 0.372$) and PEEP (6 cm H₂O vs. 6 cm H₂O, $p = 0.141$) were similar in both years, but the peak pressure (22 cm H₂O vs. 24 cm H₂O, $p = 0.011$) was lower in 2016. More patients received sedatives (70.7% vs. 57.0%, $p = 0.002$) and analgesics (86.5% vs. 51.1%, $p < 0.001$) in 2016 than in 2010. In 2016, compared to 2010, remifentanyl and dexmedetomidine were used more frequently than fentanyl and midazolam. Awakening (48.4% vs. 31.0%, $p = 0.002$) was more frequently attempted in 2016. For the 2016 cohort, light sedation was maintained in more than 50% of patients who were assessed, except for the first 5 days, and agitation was present in less than 10% of patients. However, the ICU mortality rate did not change (31.4% in 2016 vs. 35.6% in 2010, $p = 0.343$).

Although the commonly used mode rates differ between South Korea and Spain (PCV vs. VCV), the choice of mode is unlikely to affect mortality. Short-acting analgesics and sedatives were preferred after the issuance in 2013 of the Pain, Agitation, and Delirium (PAD) guidelines [8] and the preference for light sedation is related to the ease of awakening. The proportion of patients using SBT at the first attempt was 31.1% in 2016, which is lower than 89.2% in the 2010 cohort. This was likely a result of the absence of specialized teams and a standardized protocol for weaning. However, the high proportion of weaning by decreasing the support level might be associated with the use of different definitions for the beginning of weaning. Light sedation could result in a change from pressure control to pressure support and a decrease of the support level early in the ICU stay.

A limitation of the study of Sim et al. [7] is the small number of patients compared to the number of participating ICUs. The small number of patients and missing data hamper the comparison of mortality rates, as noted by the authors.

The low rate of compliance with lung protection strategies (high tidal volume and low PEEP in both cohorts) in patients with acute respiratory distress syndrome (ARDS) suggests that compliance with lung protection strategies requires attention, despite the low rate of ARDS in both cohorts.

In summary, Sim et al. [7] show the evolution of the man-

agement of mechanically ventilated patients in South Korea over 6 years. Better control of pain and agitation and increased use of active awakening attempts indicate improvements in intensive care. Finally, organizational practices such as weaning protocol and interdisciplinary meetings may promote the cessation of mechanical ventilation and improve survival.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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