“Set and forget” is not an ideal approach to pressure support ventilation: the ongoing saga of high tidal volumes

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In the current issue of *Critical Care and Resuscitation*, Al-Bassam and colleagues\(^1\) report on invasive pressure support ventilation (PSV) practices in a Victorian multicentre prospective observational trial, advancing our knowledge following the work from Pletsch-Assuncao and colleagues\(^2\) single centre trial on ventilatory overassistance. Some interesting and disturbing details are revealed. Pressure support of 10 cmH\(_2\)O was the most commonly prescribed value, which alone is not new information;\(^3\) however, what is new is that there was no change in the majority of these settings 24 hours later. Similar pressure support levels to those reported for Victorian patients have been seen to promote diaphragmatic atrophy.\(^4\) Al-Bassam et al\(^1\) also noted that “likely overassistance” was seen in between 40% and 53% of observations.\(^1\) The complex interplay between brain and brainstem and respiratory mechanics and machine with ventilatory overassistance may lead to harm, including ineffective triggering, wasted inspiratory effort, diaphragmatic wasting, and large tidal volumes.\(^5\) This observational study continues the theme of a worrying “one size fits all” and a “set and forget” approach to mechanical ventilation.

In the unfolding saga of ventilation, the landmark ARDSNet trial showed that large tidal volumes (adjusted according to gender and height) in patients meeting the criteria for acute respiratory distress syndrome (ARDS) had increased mortality.\(^6\) More recent studies showed that in heartbeating lung donors (donation after brain death), a greater percentage of viable lungs were transplanted in the group receiving protective lung ventilation.\(^7\) Patients undergoing abdominal surgery who were intermediate to high risk for pulmonary complications also had a significant improvement in morbidity if they were ventilated with protective lung ventilation.\(^8\) Tidal volumes in excess of 10 mL/kg predicted body weight in patients after cardiac surgery have been shown to have a higher risk of organ failures, including prolonged mechanical ventilation, haemodynamic instability, and renal failure,\(^9\) which is particularly risky in female patients and in patients with obesity. How we set up and change the ventilator for individual patients is meaningful and has an impact on morbidity (and possibly mortality). Why is this forgotten when it comes to PSV? The reason for a neglectful approach to setting the ventilator parameters during PSV remains unclear and requires investigation.

What we know, however, is that PSV is increasing in use. In 2009, 41% of patients were in a sole PSV mode and 9% of patients received PSV as their only mode of ventilation throughout their mechanical ventilation episode.\(^3\) International mechanical ventilation surveys have shown that the use of PSV is increasing over time, with the majority of patients receiving PSV after 6 days of ventilatory support.\(^10\) Despite this increasing use of PSV, all the lessons learnt about large tidal volumes in relation to mandatory ventilation appear forgotten, as the “set and forget” choice of setting up the ventilator dominates across Victoria and likely Australia (and perhaps New Zealand). This observation implies that intensivists in Australia and New Zealand take the view that outside of ARDS, ventilation does not matter much.\(^1\)\(^11\) This is likely to be misguided.

The importance of ventilation should not be underplayed, whether it is supported or mandatory breaths. Eyeington and colleagues\(^11\) recently described ventilation practices in Victorian patients without ARDS undergoing mandatory mechanical ventilation and noted that a third of patients had set tidal volumes of 500 mL, regardless of their gender or height. In the current study by Al-Bassam and colleagues,\(^1\) almost a quarter of observations had tidal volumes in excess of 10 mL/kg predicted body weight. Why this happens is not clear. However, what is clear is that we are besotted with tidal volumes of 500 mL and pressure support levels of 10 cmH\(_2\)O irrespective of our patients’ height, weight and, perhaps in spite of, gender.

Everything we do in the intensive care unit needs to be subjected to rigorous assessment, including — and maybe especially after these two studies — the way we practise PSV. Ventilation is a complex and delicate interplay between patient and machine, brain and brainstem, sensors and valves, with the overall goal to support lung function while minimising machine-induced injury. We need to manage mechanical ventilation during PSV with as much care and precision as we apply when managing vasopressor choice and titration, antibiotic stewardship and renal replacement therapy.
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References