Adaptive Support Ventilation: An Inappropriate Mechanical Ventilation Strategy for Acute Respiratory Distress Syndrome?

To the Editor:

Adaptive support ventilation (ASV) allows clinicians to set a maximum plateau pressure (PP) and a desired minute ventilation. Thus, ASV automatically determines the respiratory rate and tidal volume (V_T) based on its algorithms and hereto adjusts V_T to keep PP below the set maximum. In a lung model with varying mechanics, all mimicking acute respiratory distress syndrome (ARDS), Sulemanji *et al.*[1] compared ASV with conventional mechanical ventilation with a fixed V_T of 6 ml/kg. Maximum airway pressure limit was 28 cm H_2O in ASV. The major finding was that ASV "sacrifices" V_T and minute ventilation to maintain PP in some scenarios (*i.e.*, V_T was <6 ml/kg, and minute ventilation was lower than desired). As such, ASV seems a safe mode of mechanical ventilation. However, their results also suggest that ASV may be unsafe in other scenarios. Indeed, although median-delivered V_T was similar with ASV compared with conventional mechanical ventilation with a fixed V_T of 6 ml/kg (6.27 *vs.* 6.08 ml/kg in the 60-kg group and 5.24 *vs.* 6.13 ml/kg in the 80-kg group), in certain scenarios, maximum-delivered V_T could be as high as 9.0 and 8.3 ml/kg in the 60-kg group and the 80-kg group, respectively. Such large V_T can and should never be seen as safe.

The commonly held view that large V_T ventilation may be tolerated as long as the PP remains at less than 30–35 cm H_2O has been questioned in a secondary analysis of the landmark study on lung-protective lower V_T ventilation by the ARDS Network.[2] To assess for independent effects of V_T reduction on mortality, Hager *et al.*[3] constructed a multivariable logistic regression model. For this, the study groups were stratified by quartiles of PP. Hager *et al.* identified groups of patients who would have had similar PP had they been randomized to the same V_T strategy. The lower V_T strategy was associated with a lower mortality than the traditional V_T strategy in all PP quartiles. From this, we conclude that the beneficial effect of V_T reduction from 12 to 6 ml/kg is independent of PP.

The same may apply for patients at risk for ARDS. Gajic *et al.*[4] reported significant variability in the initial V_T settings in mechanically ventilated patients without acute lung injury or ARDS at the onset of mechanical ventilation. Of the patients ventilated for more than 5 days, 25% developed lung injury within 5 days of mechanical ventilation. In this study, the main risk factors associated with the development of lung injury were the use of large V_T, next to transfusion of blood products, acidemia, and a history of restrictive lung disease. The odds ratio of developing lung injury was 1.3 for each milliliter of V_T above 6 ml/kg.

In this context, we would like to stress that the terminology chosen for lung-protective mechanical ventilation (using lower V_T) is wrong and maybe even misleading. Instead of "lower" V_T, we should use the term "normal" or "normally sized" V_T. Let us compare "traffic speeding" with lung-injurious forms of mechanical ventilation: traffic speeding (using too high V_T) during "rush hours" (ARDS) is dangerous, but traffic speeding (using too high V_T) may always be dangerous, even when there are not so many other cars on the road (no ARDS); therefore, regulations (guidelines) mandate that we should drive not faster than the speed limit (6 ml/kg). "Sacrificing" lower V_T with mechanical ventilation may be dangerous.

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In Reply:

We thank Drs. Dongelmans and Schultz for their letter expressing interest in our recent publication on adaptive support ventilation (ASV).[1] They correctly describe how ASV works but indicate that the ability of ASV to vary tidal volume in response to a changing clinical presentation is of concern especially if the tidal volume is allowed to exceed 6 ml/kg.

First, it is important to remember that the tidal volumes used by the Acute Respiratory Distress Syndrome Network[2] in its landmark study varied between 4 and 8 ml/kg. Indeed, as we showed in our study, even though the average tidal volume delivered to patients in the low-tidal volume arm was about 6 ml/kg, tidal volume did vary between 4 and 8 ml/kg in many patients.

We believe that allowing tidal volume to increase while keeping plateau pressure at a minimum setting (<28 cm H_2O in our study) is the major concern of Drs. Dongelmans and Schultz, and they reference Hager *et al.*[3] to demonstrate their point. However, they failed to acknowledge the subse-