November 2017 Phoenix Critical Care Journal Club

After a hiatus, the Banner University Medical Center Phoenix/Phoenix VA critical care club was held on November 22. We reviewed recent guidelines from the ATS/ERS on mechanical ventilation for the adult respiratory syndrome (ARDS); a recent article on lung recruitment and titrated positive end-expiratory pressure (PEEP) vs low PEEP; and a review of dyssynchronous mechanical ventilation.

Mancebo J, Meade MO, McAuley DF, et al. An Official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine Clinical Practice Guideline: Mechanical Ventilation in Adult Patients with Acute Respiratory Distress Syndrome. Am J Respir Crit Care Med. 2017 May 1;195(9):1253-63. [CrossRef] [PubMed]

The ATS/ERS committee made a strong recommendation for mechanical ventilation using lower tidal volumes (4–8 ml/kg predicted bodyweight) and lower inspiratory pressures (plateau pressure,30 cm H2O) (moderate confidence in effect estimates). However, on page 1257 the summary of the evidence seems dyssynchronous with the recommendations. "Mechanical ventilation strategies that limit tidal volumes [LTV] and inspiratory pressures have been compared with traditional strategies in nine RCTs [randomized controlled trials] including 1,629 patients. …Mortality was not significantly different for patients receiving an LTV compared with traditional strategies (seven studies, 1,481 patients; risk ratio [RR], 0.87; 95% CI, 0.70–1.08; moderate confidence). There were also no significant differences in barotrauma (three studies, 1,029 patients; RR, 0.96; 95% CI, 0.67–1.37; low confidence) or ventilator-free days (VFDs) (two studies, 977 patients; 0.03 more VFDs; 95% CI, 25.88 to 5.95; low confidence) between groups.

The committee goes on to strongly recommend that patients with severe ARDS, have prone positioning for more than 12 h/d (moderate confidence in effect estimates). "Prone positioning has been evaluated in eight RCTs, including 2,129 patients but there was no significant difference in mortality for patients in the prone versus supine groups. …However, in prespecified subgroup analyses (based on proning duration, ARDS severity, concomitant LTV ventilation), prone positioning reduced mortality in trials with prone duration greater than 12 h/d (five studies, 1,002 patients; RR, 0.74; 95% CI, 0.56–0.99; high confidence) and patients with moderate or severe ARDS (five studies, 1,006 patients; RR, 0.74; 95% CI, 0.54–0.99."

For patients with moderate or severe ARDS, the committee made a strong recommendation against routine use of high-frequency oscillatory ventilation (high confidence in effect estimates) and conditional for higher positive end-expiratory pressure (moderate confidence in effect estimates) and recruitment maneuvers (low confidence in effect estimates). In each there was no difference in mortality.

It is difficult to understand why the committee made strong or even moderate recommendations when the considerable available evidence suggests that most make

no difference in mortality or secondary end points such as barotrauma or ventilator-free days.

Writing Group for the Alveolar Recruitment for Acute Respiratory Distress Syndrome Trial (ART) Investigators. Effect of lung recruitment and titrated positive end-expiratory pressure (peep) vs low peep on mortality in patients with acute respiratory distress syndrome: a randomized clinical trial. JAMA. 2017 Oct 10;318(14):1335-45. [CrossRef] [PubMed]

Many have advocated lung recruitment maneuvers and positive end-expiratory pressure (PEEP) titration to the best respiratory-system compliance in patients with moderate or severe ARDS. Although logical, the effects of these maneuvers on clinical outcomes remain uncertain. The authors conducted a multicenter, randomized trial conducted at 120 intensive care units (ICUs) from 9 countries enrolling adults with moderate to severe ARDS. An experimental strategy with a lung recruitment maneuver and PEEP titration according to the best respiratory-system compliance (n = 501; experimental group) was compared with control strategy of low PEEP (n = 509).

Compared with the control group, the experimental group strategy ***increased*** 28-day all-cause mortality, ***decreased*** the number of mean ventilator-free days, ***increased*** the risk of pneumothorax requiring drainage, and ***increased*** the risk of barotrauma. There were no significant differences in the length of ICU stay, length of hospital stay, ICU mortality, and in-hospital mortality. Based on this well-designed trial, we concluded that we would not use lung recruitment maneuvers and PEEP titration in ARDS patients.

Gilstrap D, MacIntyre N. Patient-ventilator interactions. Implications for clinical management. Am J Respir Crit Care Med. 2013 Nov 1;188(9):1058-68. [CrossRef] [PubMed]

This is a review article on dyssynchronous mechanical ventilation where ventilator support does not match patient demands. Dyssynchrony imposes high pressure loads on ventilator muscles, promoting muscle overload/fatigue and increasing sedation needs. The authors discuss maneuvers that can enhance synchrony including adjustments of the trigger variable, the use of pressure versus fixed flow targeted breaths, and manipulations of the cycle variable. The authors point out that many dyssynchronies are subtle and of little clinical relevance, but can produce patient discomfort and are a frequently cited indication for the administration of sedatives. Determining the prevalence of patient–ventilatory dyssynchrony is difficult as studies examining this question have involved varying patient populations, definitions of dyssynchrony, methods of detection, duration and timing of observation, and ventilatory modes. However, a retrospective evaluation of the National Institutes of Health (NIH) ARDS Network small VT study reported cycling dyssynchronies associated with double triggering in 9.7% of all breaths analyzed suggesting it may be relatively common.

The authors discuss two new approaches to improving patient ventilatory interactions: proportional assist ventilation (PAV) and neurally adjusted ventilatory assist (NAVA).

PAV breaths are patient-initiated breaths triggered in a conventional way using circuit pressure or flow sensors. Thereafter, the ventilator continues to monitor flow and volume demanded by the patient and puts a clinician-set “gain” on this demand to augment flow and pressure in proportion to the desired reduction in the patient’s work of breathing. NAVA requires a unique esophageal catheter with an array of diaphragm electromyogram (EMG) sensors. These sensors detect the onset, intensity, and termination of inspiratory efforts directly. Like PAV, a clinician-set gain is then applied that determines flow and pressure delivery in proportion to the EMG signal.

Although there was general agreement that it is unclear if correcting dyssynchrony improves outcomes, most thought this was an excellent, well-balanced review article.

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