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.


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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