The authors have disclosed no conflicts of interest.

DOI: 10.4187/respcare.04795

REFERENCES

1. Natalini G, Tuzzo D, Rosano A, Testa M, Grazioli M, Pennestrì V, et al. Assessment of factors related to auto-PEEP. Respir Care 2016;61(2):134-141.
2. Rossi A, Polese G, Brandi G, Conti G. Intrinsic positive end-expiratory pressure (PEEPi). Intensive Care Med 1995;21(6): 522-536.
3. Appendini L, Patessio A, Zanaboni S, Carone M, Gukov B, Donner CF, Rossi A. Physiologic effects of positive end-expiratory pressure and mask pressure support during exacerbations of COPD. Am J Respir Crit Care Med 1994;149(5):1069-1076.
4. Appendini L, Purro A, Patessio A, Zanaboni S, Carone M, Spada E, et al. Partitioning of inspiratory muscle workload and pressure assistance in ventilator-dependent COPD patients. Am J Respir Crit Care Med 1996;154(5):1301-1309.
5. Goldstone J, Moxham J. Weaning from mechanical ventilation. Thorax 1991; 46(1):56-62.

PEEP and Mechanical Ventilation: We Are Warned, We Cannot Ignore—Reply

In reply:

We are grateful to Dr Appendini and colleagues for their comment and appreciation.

The similar expiratory time used in patients with high and low auto-PEEP levels does not diminish the lack of relationship between auto-PEEP and expiratory time (if anything, it made the statistical analysis more consistent).

We definitely believe that the ventilator settings could have been improved in some subjects enrolled in the study. Namely, expiratory time should be increased in patients with significant levels of auto-PEEP. Our findings suggest that such an increase should be proportional to the time constant of the respiratory system.

Therefore, we agree with Appendini and colleagues that in some cases, breathing pattern manipulation (ie, the decrease of breathing frequency and/or inspiratory time) could be advisable in mechanically ventilated patients with auto-PEEP.

On the other hand, we should always keep in mind that expiratory time can be set only in patients undergoing controlled ventilation, whereas it cannot be imposed during any modality of assisted ventilation, when expiration is ended by patient inspiratory triggering. On the contrary, medical therapy and patient position can effectively reduce auto-PEEP both during controlled and during assisted ventilation and therefore play a fundamental role in clinical practice, in particular during weaning from mechanical ventilation.

Giuseppe Natalini MD
Department of Anesthesia and Intensive Care
Fondazione Poliambulanza Hospital
Brescia, Italy

Daniele Tuzzo MD
Department of Anesthesia and Intensive Care
Spedali Civili Hospital
Brescia, Italy

Antonio Rosano MD
Department of Anesthesia and Intensive Care
Fondazione Poliambulanza Hospital
Brescia, Italy

The authors have disclosed no conflicts of interest.

DOI: 10.4187/respcare.04862

Transcutaneous Carbon Dioxide in the Management of Noninvasive Ventilation

To the Editor:

Respiratory monitoring during noninvasive mechanical ventilation (NIV) allows evaluation of its efficiency and prevention of any delay in the initiation of invasive mechanical ventilation and the occurrence of related complications. The measurement of breathing frequency, pulse oximetry, arterial blood gas analysis, and capnography are commonly employed methods for this purpose. Direct monitoring of P_{CO_2} is particularly important in the management of patients with hypercapnic respiratory failure. Direct measurement of arterial P_{aCO_2} using arterial blood gas analysis is the accepted standard method; however, the inability of this method to provide continuous monitoring and its invasive nature have spurred research for an alternative method.[1] The studies have focused on end-tidal P_{CO_2} and transcutaneous measurement of P_{CO_2} (P_{tcCO_2}) due to their ability to provide continuous monitoring and their noninvasive nature. P_{tcCO_2} is especially used to evaluate alveolar ventilation in patients with nocturnal hypoventilation receiving NIV in the home setting. The studies demonstrated the correlation between P_{tcCO_2} and P_{aCO_2} values.[2]

In the study titled "What is the potential role of transcutaneous carbon dioxide in guiding acute noninvasive ventilation?" Van Oppen et al[3] evaluated the correlations between $P_{tcCO_2} - P_{aCO_2}$ and arterial pH-calculated transcutaneous pH and the relationship of the 2 methods with the pain scores in 9 subjects undergoing NIV due to hypercapnic respiratory failure. The study measurements were performed with 4-h intervals in the first 12 h after the initiation of NIV.

According to Bland-Altman analysis, transcutaneous pH was, in general, consistent with arterial pH; however, this relationship was weaker in the case of severe acidosis, as evidenced by the pH value measured, <7.30. A similar relationship was found between P_{tcCO_2} and P_{aCO_2}. This relationship was weaker in the case of severe acidosis when P_{aCO_2} was >65 mm Hg. They suggested that NIV could be guided using bicarbonate and pH values predicted using the algorithms, and this approach would also reduce the number of blood samplings for arterial blood gas analysis. The utility of this method only when pH is not <7.30 and in the presence of pure respiratory acidosis, which is not accompanied by metabolic acidosis, may limit its use in clinical practice. However, the predicted values when baseline bicarbonate is measured >34.0 mmol/L do not reflect the actual values, and this necessitates the use of further algorithms.

As the secondary outcome measure of the study, pain score was significantly lower compared with arterial blood sampling during transcutaneous monitoring. There are also studies suggesting that the correlation between P_{tcCO_2} and P_{aCO_2} in subjects undergoing NIV is suboptimal and that P_{tcCO_2} cannot substitute for P_{aCO_2}.[4] Although P_{tcCO_2} monitoring is a noninvasive method and seems to be superior in showing the efficiency of treatment, more studies with a larger number of cases are required to establish its place in cases with acute respiratory failure.

Eren Fatma Akcil MD
Department of Anesthesiology and Intensive Care