CRITICAL CARE

COMMENTARY

Automated detection of patient-ventilator asynchrony: new tool or new toy?

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See related research by Sinderby et al. http://ccforum.com/content/17/5/R239

Abstract

Although severe patient-ventilator asynchrony is frequent during invasive and non-invasive mechanical ventilation, diagnosing such asynchronies usually requires the presence at the bedside of an experienced clinician to assess the tracings displayed on the ventilator screen, thus explaining why evaluating patient-ventilator interaction remains a challenge in daily clinical practice. In the previous issue of *Critical Care*, Sinderby and colleagues present a new automated method to detect, quantify, and display patient-ventilator interaction. In this validation study, the automatic method is as efficient as experts in mechanical ventilation. This promising system could help clinicians extend their knowledge about patient-ventilator interaction and further improve assisted mechanical ventilation.

In the previous issue of *Critical Care*, Sinderby and colleagues [1] compare the analyses by experts and by an innovative automated method to detect and quantify patient-ventilator interaction in ventilator tracings from a previously published study. There is very good agreement between the two approaches and this opens up some exciting prospects.

Indeed, even if we have successfully used patient-triggered assisted ventilation for more than 20 years and even if (compared with controlled ventilation) this allows a reduction in sedation needs [2] and a decrease in ventilator-induced diaphragmatic dysfunction [3], we still have not solved the problem of patients 'fighting' against their ventilators. This phenomenon, commonly called patient-ventilator asynchrony [4], is related mainly to the fact that during assisted ventilation, especially during

pressure support, ventilator-delivered pressurization does not exactly match the characteristics of patients' inspiratory demand [5]. As a consequence, severe patient-ventilator asynchrony occurs in one fourth of invasively ventilated patients [6] and in more than 40% of non-invasively ventilated patients [7].

Even if patient-ventilator asynchrony is very common, studying this phenomenon remains a challenge in daily clinical practice [8]. Indeed, its correct diagnosis usually requires the presence at the bedside of an experienced clinician to assess the tracings displayed on the ventilator screen, which is not possible 24 hours a day. Additionally, up to now, a really sensitive and reliable detection of patient-ventilator asynchronies could only be performed offline by an expert using the simultaneous recording of diaphragmatic electrical activity (Eadi) flow and pressure–time curves [8], an option clearly limited to research purposes.

Only an efficient and easy-to-use automated system could help in the real-time diagnosis of patient-ventilator asynchronies at the bedside. As the automated system introduced by Sinderby and colleagues [1] assesses patient-ventilator interaction by automatically comparing ventilator pressure and Eadi waveforms as efficiently as experienced clinicians, it provides, for the first time, a true opportunity of continuously monitoring patient-ventilator interaction in routine clinical practice. Given that a high number of asynchronies have been associated with suboptimal ventilator settings such as excessive levels of pressure support or poorly adapted expiratory trigger setting [9,10], this new monitoring tool also offers the opportunity to better adapt ventilator settings during assisted ventilation by providing real-time feedback to intensive care clinicians. Furthermore, improved closed-loop systems using the automated detection of patient-ventilator asynchronies to continuously and automatically adapt ventilator settings could be implemented in ventilators to further improve the standard of care during mechanical ventilation.

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Perhaps more importantly, poor patient-ventilator asynchrony has been associated with increased respiratory muscle workload [11], prolonged mechanical ventilation duration [6,12], and poorer outcome in difficult-to-wean patients [13]. However, whether patient-ventilator asynchronies simply occur more frequently in more severely ill patients or whether the occurrence of patient-ventilator asynchronies is by itself responsible for the poor prognosis is still unknown. Answering this important question requires large-scale clinical studies to assess the impact on patients' outcome of using ventilator strategies which can improve patient-ventilator synchrony, as, for instance, new ventilatory modes such as neurally adjusted ventilatory assist or proportional assist ventilation [14,15] or Eadi-based algorithms to adapt the ventilator settings during pressure support. However, given that, until now, analyzing patient-ventilator synchrony required manual cycle-by-cycle analysis of the ventilator tracings, such large-scale studies could never be performed. By allowing an automated detection, quantification, and display of patient-ventilator asynchronies, the system introduced by Sinderby and colleagues [1] could provide the opportunity to conduct large-scale outcome studies on the impact of correcting patient-ventilator asynchrony. Finally, this system gives the possibility of diagnosing timing errors between Eadi and pressure curves with increased sensitivity compared with standard manual analysis. This, in turn, provides an interesting new tool to further assess patient-ventilator synchrony and maybe to define a cutoff between acceptable and unacceptable synchrony.

In summary, the automated system presented by Sinderby and colleagues [1] to automatically detect, quantify, and display patient-ventilator asynchrony is a promising monitoring tool that should help intensive care clinicians extend their knowledge of patient-ventilator interaction and further improve assisted mechanical ventilation.

Abbreviation
Eadi: Diaphragmatic electrical activity.

Competing interests
The authors declare that they have no competing interests.

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