Asynchrony Consequences and Management

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KEYWORDS

• Mechanical ventilation • Dyssynchrony • Airway pressure • Monitoring
• Work of breathing

KEY POINTS

- Dyssynchrony is a mismatch between the patients' inspiratory and expiratory times and the mechanical ventilator delivery.
- Dyssynchrony is associated with worse outcomes, but causality has not been shown; it is unknown if controlling dyssynchrony can lead to a better outcome.
- There is not a single dyssynchrony, but several types with different mechanisms, consequences, and potential management.
- A simple visual monitoring of the ventilator screen can detect gross dyssynchrony, but automated systems are needed.

INTRODUCTION: WHAT IS DYSSYNCHRONY AND WHY DOES IT MATTER?

Mechanical ventilation is the most common life support procedure in the intensive care unit (ICU).[1] It is used in a full spectrum of acute situations, which share the same primary goals: to maintain gas exchange, reduce the work of breathing, and improve patient comfort. Depending on the severity and timing of the patients' course, mechanical ventilation can fully control and suppress the patients' respiratory load or be used as partial ventilatory support, that is, preserving spontaneous effort to a certain extent. An ideal delivery of mechanical ventilation would reduce respiratory distress by decreasing excessive respiratory load, while maintaining an appropriate level of spontaneous effort (preventing diaphragm and respiratory muscle atrophy)

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with harmonious patient-ventilator interaction. However, this situation is not always met; when this fragile balance is jeopardized, patient-ventilator dyssynchrony occurs. Dyssynchrony is defined as a mismatch between the patients' own inspiratory and expiratory times and the mechanical ventilator delivery.[2] This mismatch often reveals a discrepancy between the patients' needs and the amount of assistance delivered by the machine. Dyssynchrony then becomes a complex phenomenon involving interaction of the ventilator with several organs, namely, the lungs; the respiratory muscles, including the diaphragm; and the nervous system, including the respiratory centers[3] (**Fig. 1**). Dyssynchrony detection requires a careful examination of flow and airway pressure (Paw) waveforms displayed on the ventilator screen,[4] along with clinical examination of the patients' breathing pattern. Dyssynchronies can easily be missed by clinicians who cannot continuously stare at the screen or may not recognize them. More advanced monitoring, for example, using esophageal manometry or electrical activity of the diaphragm, can help clinicians to detect dyssynchrony; but these are not routinely used in daily clinical practice.[5,6]

Ventilated patients are regularly managed while ignoring dyssynchrony: so why should we focus on this topic? *First*, even if precise epidemiologic data on dyssynchrony are lacking, it seems to be a frequent event in ventilated patients; we can roughly estimate that at least one-third of patients exhibit frequent dyssynchrony during mechanical ventilation.[7–10] *Second*, observational studies have consistently found dyssynchrony to be associated with poor outcomes, such as longer duration of ventilatory support and higher mortality.[8,11] Reducing dyssynchrony by adapting ventilatory conditions is often feasible.[12,13] Therefore, although association does not prove causality, there might be a chance to improve clinical outcomes by reducing/avoiding patient-ventilator dyssynchrony. Dyssynchrony may contribute to lung injury or respiratory muscle dysfunction as well as having an impact on patient comfort.

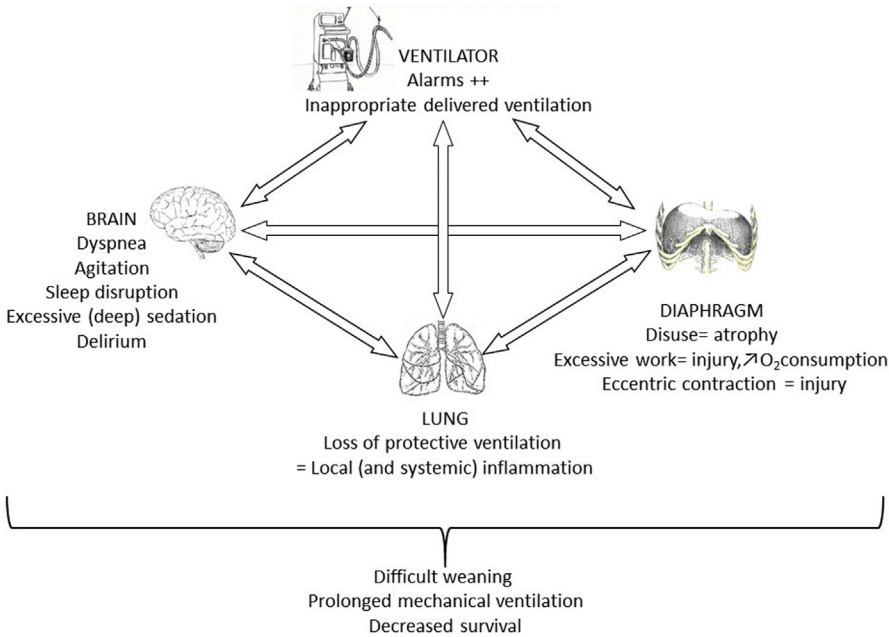

Fig. 1. Interactions between organs and ventilator involved in dyssynchrony and their consequences.