Identifying asynchronies: Delayed cycling

Víctor Perez [1], Jamille Pasco [2]

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Abstract

Patient-ventilator asynchrony/dysynchrony is a mismatch between the patient and the ventilator's delivered breaths and the ability of the ventilator to meet the patient demands.

Any factor that alters the harmony between these two components produces asynchrony, which can cause discomfort and an increase in the patient's work of breathing.

Delayed cycling occurs when the neural time is less than the mechanical time of the ventilator.

Keywords: asynchrony, ventilator, delayed cycling, work of breathing, neural time, mechanical time.

Authors
1. Víctor Pérez Cateriano. Intensive Care Medicine. Master in Health Services Management. Ate Vitarte Emergency Hospital. Lima, Perú.
2. Jamille Charlot Pasco Ulloa. Intensive Care Medicine. Alberto Barton Hospital. Callao, Perú.

Corresponding author: Víctor Pérez Cateriano.
Email: vpc051@gmail.com

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Patient-ventilator asynchrony is a mismatch between the patients' and the ventilator's delivered breaths and the ability of the ventilator to meet the patients' demands. [1]

Two pumps participate in the patient-ventilator interaction: on one hand, the patient's respiratory system, neurologically controlled and influenced by the mechanical properties of the lungs and thorax; and on the other, the ventilator, controlled by the ventilator settings. [2] Any factor that alters the harmony between these two pumps produces asynchrony, which can cause discomfort and an increase in the patient's work of breathing. [3]

Asynchronies are common in intensive care units (ICU) with an incidence of up to 25%. [4] They can be classified according to the phase of the ventilatory cycle in which they occur. [5]

Among them we have the cycling asynchronies, produced at the end of inspiration, which can be due to premature or delayed cycling. [3]

Delayed cycling occurs when the neural time is less than the mechanical time of the ventilator. [6,7]

It can be caused by a prolonged inspiratory time secondary to conditions with high time constant (determined by the respiratory system mechanics: resistance and compliance) as COPD, high pressure support level, or very low cycling criteria in the pressure support mode (the percentage of flow decay at which the ventilator cycles from inspiration to exhalation), or by a volumen controlled continuous mandatory ventilation settings that result in long inflation time (high tidal volume or low inspiratory flow). [8]

It can produce dynamic hyperinflation, especially in obstructive conditions, which causes trigger-delay and increases the number of ineffective efforts. [3]

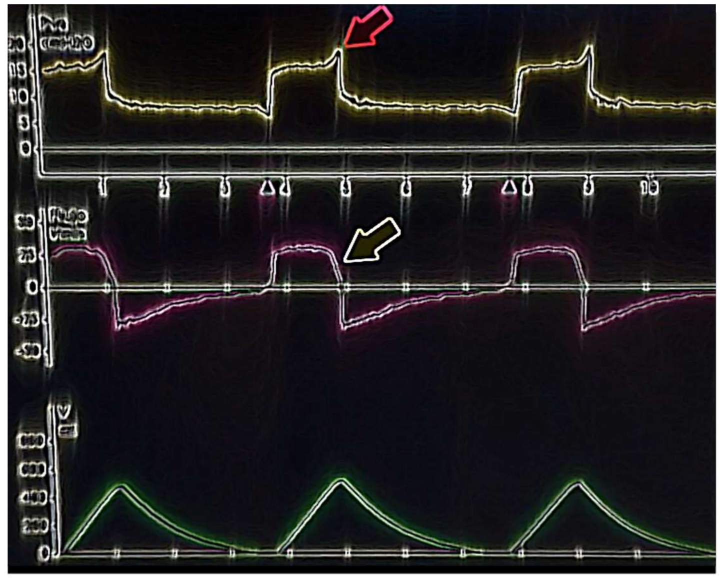

Figure 1 Delayed cycling during the pressure support ventilation mode. From top to bottom: pressure-time, flow-time and volume-time curves. Cycling criterion set at 25%. The patient exhales before the end of the mechanical inspiratory time, which produces a spike in the pressure-time curve (red arrow) and a rapid drop in the inspiratory flow curve, close to the end of inspiration (yellow arrow).

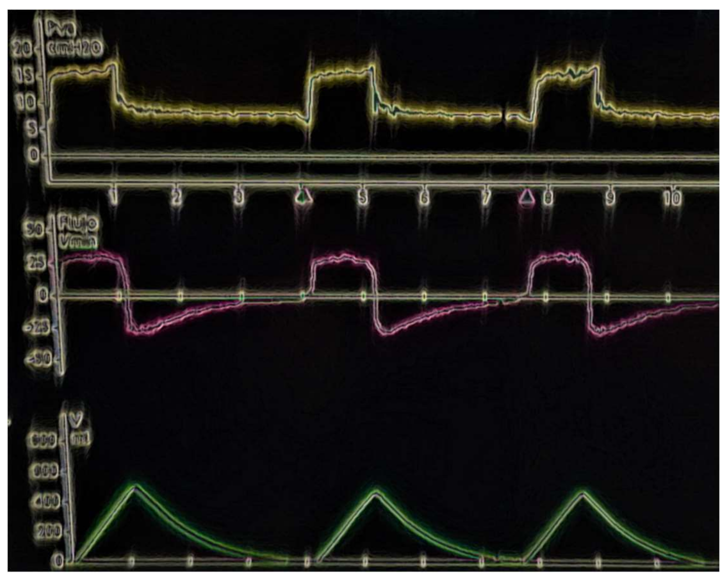

Figure 2 Partial correction of delayed cycling. The cycling criterion was increased to 35%, reducing the mechanical inspiratory time to match the neural inspiratory time. Delayed cycling images are presented in a patient recovering from COVID-19 ARDS.

References

1. Sassoon CS, Foster GT. Patient-ventilator asynchrony. Curr Opin Crit Care 2001; 7:28-33.

2. Kondili E, Prinianakis G, Georgopoulos D. Patient-ventilator interaction. Br J Anaesth 2003; 91(1):106-119.

3. Nilsestuen JO, Hargett KD. Using ventilator graphics to identify patient-ventilator asynchrony. Respir Care 2005; 50(2):202-234.

4. Thille AW, Rodriguez P, Cabello B, et al. Patient-ventilator asynchrony during assisted mechanical ventilation. Intensive Care Med 2006; 32:1515-1522.

5. Mireles-Cabodevila E, Siuba MT, Chatburn RL. A Taxonomy for patient-ventilator interactions and a method to read ventilator waveforms. Respir Care 2022; 67(1):129-148.

6. Mirabella L, Cinnella G, Costa R, et al. Patient-ventilator asynchronies: clinical implications and practical. Respir Care 2020; 65(11):1751-1766.

7. Ranieri VM, Squadrone V, Appendini L, et al. Patient-ventilator interaction. In Vincent JL, Abraham E, Moore FA, Kochanek PM, Fink MP. Textbook of critical care. 7th ed. Philadelphia: Elsevier; 2017; 366-372.

8. Bonetto C, Calo MN, Delgado MO, et al. Modes of pressure delivery and patient-ventilator interaction. Respir Care Clin N Am 2005; 11:247-263.