Multidisciplinary Respiratory Medicine

SUPPLEMENTARY MATERIAL

doi: 10.4081/mrm.2020.650

# Patient-ventilator asynchrony in conventional ventilation modes during short-term mechanical ventilation after cardiac surgery: randomized clinical trial

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## METHODS

### Protocol

Upon admission to the ICU, patients received routine postoperative care, were monitored and positioned with headrest elevated to 30º. A 32-electrode strap was attached to their thorax and connected to the DX Enlight 1800 electrical impedance tomography (EIT) apparatus (Timpel, Brazil) with a flow sensor (Respironics Novametrix, Wallingford, USA) connected to the orotracheal tube.

Patients were initially ventilated in assisted-controlled mode (A/C) by volume (VCV group) or by pressure (PCV group) according to the assigned allocation. An external volunteer researcher

managed the randomization and allocation order set by a free online software (www.randomization.com) and transferred it to opaque, sealed and numbered envelopes opened on the day of the collection. Depending on the bed reservation for the patients, they could either be assigned to an Engstrom Pro ventilator (GE Medical, USA) or Savina 300 ventilator (Dräger, Germany). Passive humidifiers were provided for all patients.

Corresponding to the T1 phase, VCV or PCV assist-controlled ventilation had its initial parameters configuration set as: tidal volume (or delta pressure) around 8ml/pbw, respiratory rate between 12-20 ipm, minimum $FiO_2$ possible to maintain $SpO_2$ ≥90%, PEEP between 5 and 8 cmH2O, and inspiratory trigger at 2L/min. The T2 phase corresponded to the A/C-PSV transition for MV weaning, which had adjustments of $FIO_2$, PEEP, pressure support and expiratory sensitivity at 25% of peak inspiratory flow. Finally, T3 represents the readiness for MV weaning, in which patients were ventilated with PS of 7cm$H_2O$, PEEP of 5cm$H_2O$ and $FiO_2$ <40%[1].

**Data analysis**

Asynchrony recording was non-invasive through recordings of flow, pressure and volume curves by air with the integrated flow sensor of the electrical impedance tomography. Each patient obtained a total of 15 minutes of recording, of which 5 minutes correspond to each ventilation moment: T1, T2 and T3. Prior to recording the signals to avoid interference, the presence of condensate in the fan circuit was verified, if present, the residue was discarded.

Based on the estimates of the synchronous and asynchronous cycles obtained through the visual inspection method, the following derived measures were calculated:

- total number of ventilatory cycles, determined by the sum of cycles triggered or not;
- number of specific asynchronies according to the definitions described in the Figure 1 (main text);
- total asynchrony index (AIt) calculated according to equation (1), having as numerator the total number of asynchronous cycles;

$$AI_t = \frac{n\ ciclos\ com\ assincronia_{total}}{n\ total\ de\ ciclos\ disparados\ ou\ \ não} \cdot 100 \qquad \text{eq. A1}$$

- indexes of specific asynchrony were calculated according to the equation (2), having as numerator the number of asynchronous cycles with IIE - effective inspiratory effort; DT - double-triggering; EC- early cycling; IEE- ineffective expiratory effort or RT- reverse triggering.

$$AI_{especifico} = \frac{n\ ciclos\ com\ assincronia\ _{especifico}}{n\ total\ de\ ciclos\ ventilatorios} \cdot 100 \qquad \text{eq. A2}$$

**Statistical analyses**

The odds of 10% or higher were expressed as odds ratios (OR) by Cochran-Mantel Haenzel test in the following scenarios:

- AI association of 10% or higher with VCV *vs* PCV;
- AI association of 10% or higher with T1 and T2 phases
- association of AI of 10% or higher with phases T1 and T3
- association of AI of 10% or higher with phases T2 and T3
- AI association of 10% or higher with VCV and PCV modes stratified by T1 and T2.
- association of AI of 10% or higher with VCV and PCV modes stratified by T1 and T3.
- association of AI of 10% or higher with VCV and PCV modes stratified by T2 and T3.

Due to the variability of occurrence of asynchrony types, the OR was estimated with all cases weighted by the total asynchronies.