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CORRESPONDENCE

Complete assessment of respiratory mechanics during pressure support ventilation

Mehdi Mezidi[1,2] and Claude Guérin[1,2,3,4,5*]

Dear Editor,

Patient and next of kin gave agreement for participating in the study.

We read with great interest the paper by Bellani et al. on measurement of respiratory mechanics during mechanical assisted breathing [1]. A 59-year-old man during weaning from invasive mechanical ventilation (Evita XL, Draeger) was included in a physiologic study. At the time of spontaneous breathing trial (pressure support ventilation 7 cmH_2O and positive end-expiratory pressure 4 cmH_2O), esophageal pressure (Pes), airway pressure (Paw), and flow were recorded. An end-inspiratory occlusion was performed 30 min after the onset of spontaneous breathing trial (Fig. 1): Paw increased from 10.5 to 21.3 cmH_2O then reached a plateau. The same was true for Pes. Important information was derived. First, plateau Paw was validated as an accurate measurement of alveolar pressure. Second, total pressure across the respiratory system was obtained according to the equation of motion of the respiratory system [2]. Third, a complete description of respiratory mechanics can be done [3]. Fourth, the driving pressure can be measured in more detail. Fifth, the muscular pressure can be computed by subtracting maximal downward deflection of Pes from static Pes at a given volume, i.e., tidal volume. It should be mentioned that patient effort can be evaluated by the pressure muscular index [4] only from the Paw profile with no need for Pes (Fig. 1). It is also worth noticing that dys-synchrony in the breath preceding the occluded breath could be related to cardiac oscillations as shown in the Pes tracing (Fig. 1). Assessment of respiratory mechanics should be performed in patients under pressure support ventilation, a mode as frequently used as volume controlled by the first week of mechanical ventilation in ICU. The information derived is potentially useful to prevent the risk of patient self-inflicted lung injury and volutrauma.

*Correspondence: claude.guerin@chu-lyon.fr
[1] Service de Médecine intensive-réanimation, Hospices civils de Lyon, Lyon, France
Full author information is available at the end of the article

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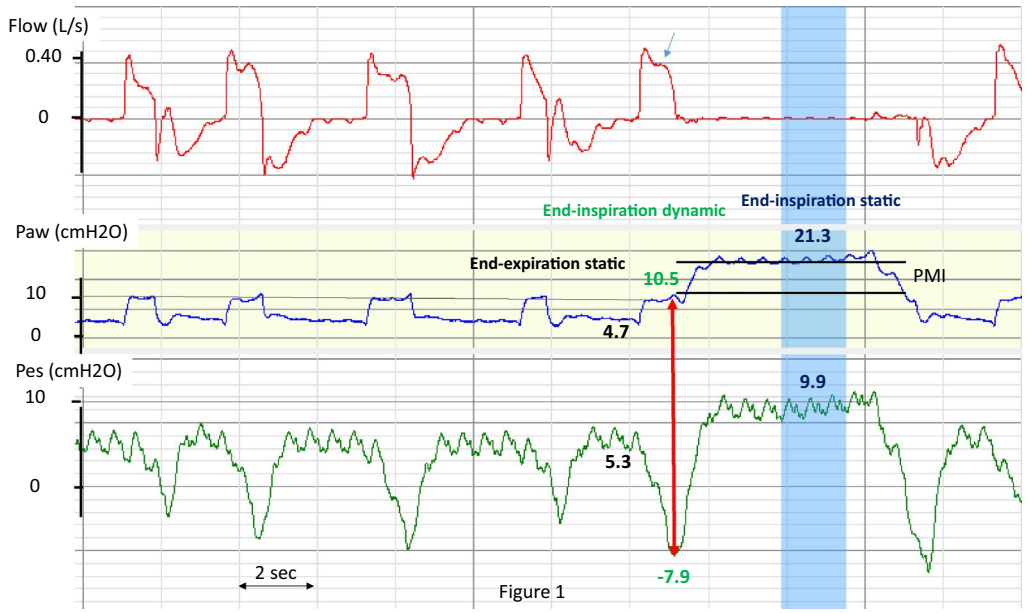

Fig. 1 From top to bottom records of flow, airway (Paw), and esophageal (Pes) pressures. Respiratory muscles were getting relaxed after the end-inspiratory pause (vertical blue area). Static end-expiratory Paw, Pes, and transpulmonary pressure (P_L = Paw − Pes) were 4.7, 5.3, and −0.6 cmH_2O, respectively. Static end-inspiratory Paw, Pes, and P_L were 21.3, 9.9, and 11.4 cmH_2O, respectively. Static driving pressure (DP,st = static end-inspiratory − static end-expiratory pressure) values of respiratory system, chest wall, and lung were 16.6 (21.3–4.7), 4.6 (9.9–5.3), and 12 (16.6–4.6) cmH_2O, respectively. It is worth emphasizing that driving pressure of respiratory system (DPrs) was 16 cmH_2O while the pressure support level was set to 7 cmH_2O above positive end-expiratory pressure. Static elastance (Est = DP,st/tidal volume) values of respiratory system, chest wall, and lung were 40, 11, and 29 cmH_2O/L, respectively (tidal volume 0.42 L). Static end-inspiratory P_L from elastance ratio method was 15.4 cmH_2O. This was computed as static end-inspiratory Paw times lung to respiratory system static elastance ratio. Dynamic transpulmonary driving pressure (DPdyn, L) was 18.4 cmH_2O (red vertical arrow). The lung resistive pressure was 7 cmH_2O. It was obtained by subtracting static P_L (lung recoil) from DPdyn, L. Lung resistive pressure divided by the inspiratory flow of 0.38 L/s at the time of end-inspiratory occlusion (thin blue arrow) afforded the lung flow resistance which was 18 cmH_2O/L/s. Muscular pressure was 17.8 cmH_2O and was obtained by subtracting the maximal negative swing of Pes from the static Pes (chest wall recoil). Inspiratory effort can also be assessed by using the pressure muscular index (PMI), which is based on Paw only, and hence does not require Pes. PMI (the distance between the two horizontal black lines) is the difference between plateau Paw and the sum of positive end-expiratory pressure and set pressure support level

Author details
[1] Service de Médecine intensive-réanimation, Hospices civils de Lyon, Lyon, France. [2] Université de Lyon, Lyon, France. [3] Service de Médecine intensive-réanimation, Grenoble, France. [4] HP2, INSERM 1042, Grenoble, France. [5] INSERM 955, Créteil, France.

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Compliance with ethical standards

Conflicts of interest
The authors declare no conflict of interest.

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