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Adrián Gallardo[a,b,*], Aldana Silvero[a], Santiago Saavedra[c]

[a] *Servicio de Kinesiología, Sanatorio Clínica Modelo de Morón, Morón, Buenos Aires, Argentina*
[b] *Universidad Nacional de La Matanza, Departamento de Ciencias de la Salud, Kinesiología y Fisiatría, San Justo, Argentina*
[c] *Servicio de Medicina Física y Rehabilitación, Hospital Alemán, CABA, Buenos Aires. Argentina*

* Corresponding author.
E-mail address: adriankgallardo@gmail.com (A. Gallardo).

Respuesta a ''High flow in tracheostomized patients on their first attempt to wean from mechanical ventilation: More questions on the table''

Reply to: ''Alto flujo en pacientes traqueostomizados en su primer intento de desvinculación de la ventilación mecánica: más preguntas sobre la mesa''

Dear Editor,

Thank you for your interest in our case series, where we found that high-flow oxygen therapy via tracheostomy (HFT) did not lead to improvements in inspiratory effort, as measured by diaphragmatic ultrasound, in patients weaning from mechanical ventilation.[1]

Your insights regarding the potential influence of peripheral muscle weakness and the duration of mechanical ventilation on our results are highly pertinent. In our study, among patients with muscle weakness (MRC < 48), HFT increased diaphragmatic excursion by 0.45 mm (IQR −7.5, 2.8), while standard oxygen therapy (SOT) led to a slight decrease of 0.15 mm (IQR −2.7, 1.9). In patients with an MRC score > 48, HFT increased excursion by 2.1 mm (IQR −12, 12.7), compared to a 1 mm decrease (IQR −3.6, 8.1) with SOT. However, these differences were not statistically significant.

For changes in diaphragmatic thickening fraction (Tfdi), in patients with an MRC score < 48, HFT led to a slight decrease of 0.1% (IQR −0.49, 0.095), whereas SOT resulted in a small increase of 0.11% (IQR 0.04, 0.145). In patients with MRC > 48, HFT increased Tfdi by 0.21% (IQR −0.16, 0.36) compared to a 0.02% increase with SOT (IQR −0.21, 0.12). Once again, no statistical significance was observed. These findings suggest that peripheral muscle weakness did not affect the results of our study.

We also examined the potential impact of mechanical ventilation duration, using 17 days (the median in our study) as a cutoff. Among patients ventilated for less than 17 days, HFT led to an increase in diaphragmatic excursion of 2.8 mm (IQR 1, 3.1) and a small decrease in Tfdi of 0.03% (IQR −0.09, 0.06). In the SOT group, diaphragmatic excursion increased by 2 mm (IQR −1.3, 3) and Tfdi by 0.02% (IQR 0, 0.13). These findings were not statistically significant, suggesting that ventilation duration did not influence the outcomes.

Regarding the inspiratory flow rate used, your observation about its relationship with peak inspiratory tidal flow during pressure support ventilation before disconnection is very insightful.[2] Our study focused on inspiratory effort measured by diaphragmatic ultrasound, so we did not assess airway pressure or peak inspiratory flow. However, based on previous research, we used flow rates of 60 L/min, which we believe are sufficient to obtain the physiological benefits of HFT.[3–5]

Lastly, the changes we observed in respiratory rate during HFT were minimal: 0 rpm (IQR −1, 2) compared to 0 rpm (IQR 0, 2) with SOT. Given the lack of significant changes, we conclude that HFT does not improve inspiratory effort in tracheostomized patients weaning from mechanical ventilation.

Thank you for your detailed observations. Addressing these clarifications is essential for accurately interpreting our findings and guiding further investigations in this specific area.

During the preparation of this work, the authors used ChatGPT to enhance the writing and understanding of the text. After utilizing this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the final version of the publication.

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Ignacio Fernández Ceballos[a,b,*], Ivan A. Huespe[a], Indalecio Carboni Bisso[a], Marcos J. Las Heras[a]

[a] *Critical Care Department, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina*

[b] *Critical Care Department, Hospital Italiano de San Justo Agustín Roca, Buenos Aires, Argentina*

* Corresponding author.
E-mail address: ignacio.fernandez@hospitalitaliano.org.ar (I. Fernández Ceballos).

From geometric equations to dynamic strategies: advances in the personalization of mechanical ventilation through mechanical power

De ecuaciones geométricas a estrategias dinámicas: avances en la personalización de la ventilación mecánica mediante la potencia mecánica

Dear Editor:

The concept of mechanical power in mechanical ventilation is intrinsically derived from the equation of respiratory motion. The equation of motion in mechanical ventilation is a fundamental tool for understanding the interaction between the forces applied by the ventilator and the biomechanical properties of the respiratory system in a one-dimensional plane. This equation describes how ventilatory pressures must be adjusted to generate the necessary airflow and overcome the elastic and resistive forces of the lungs and the thoracic cavity.[1]

However, mechanical power goes a step further by integrating these forces on a cyclical and dynamic basis, multiplying the work of breathing by the respiratory rate to obtain the total rate of energy transfer. This is crucial, as the repetitive forces applied to the lungs during mechanical ventilation can accumulate and lead to micro-injuries and structural damage, a phenomenon that cannot be fully captured by simply measuring static pressures or volumes.[2]

The concept was first formalized in the scientific medical literature by Gattinoni et al. in 2016. In its basic formula, it included parameters such as tidal volume (VT), respiratory rate (RR), peak pressure (Ppeak), and driving pressure, with a predominantly static focus. The idea was that integrating all these variables better represented the overall risk of ventilator-associated lung injury (VALI) than measuring each parameter in isolation (Table 1). Both the study conducted by Gattinoni and that of subsequent researchers focused on quantifying the mechanical energy applied to the lung from a simplified perspective, previously referred to as volutrauma and barotrauma or traditionally known as volutrauma and barotrauma, optimizing ventilation by limiting peak inspiratory pressures and driving pressure (ΔP), without explicitly considering the dynamics of lung tissue.[3]

In contrast, Santer et al. (2022) and González-Castro et al. (2024) advance toward a more dynamic biomechanical approach. They incorporate the concept of pulmonary strain (the relationship between tidal volume and lung capacity) and its rate of change (strain rate), addressing cyclic deformation and its impact on tissue damage in volume- and pressure-controlled modes. This perspective reflects a more complex understanding of the ventilation-induced cumulative damage, through which not only the size of the pressures exerted is relevant but also the frequency and speed of tissue deformation. By integrating these components, they aim to offer a more accurate predictive model to assess the risk of VALI, assuming a framework that potentially captures both the transferred mechanical energy and the underlying mechanisms of tissue deformation.[4,5]

Future perspectives in the field of mechanical ventilation may focus on advancing biomechanical models that integrate strain and strain rate, allowing for more precise monitoring of pulmonary deformation and tissue damage in real-time, while optimizing ventilation. This will eventually lead to a more dynamic approach by adjusting ventilatory parameters based on individual pulmonary resilience rather than solely relying on traditional pressures and volumes.

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