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

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

Sr. Editor:

El concepto de potencia mecánica en ventilación mecánica se deriva intrínsecamente de la ecuación del movimiento respiratorio. La ecuación del movimiento en ventilación mecánica es una herramienta fundamental para comprender la interacción entre las fuerzas aplicadas por el ventilador y las propiedades biomecánicas del sistema respiratorio en un plano monodimensional. Esta ecuación describe cómo las presiones ventilatorias deben ajustarse para generar el flujo de aire necesario y vencer las fuerzas elásticas y resistivas de los pulmones y la caja torácica[1].

Sin embargo, la potencia mecánica va un paso más allá al integrar estas fuerzas sobre una base cíclica y dinámica, multiplicando el trabajo respiratorio por la frecuencia respiratoria para obtener la tasa total de transferencia de energía. Esto es fundamental, ya que las fuerzas repetitivas aplicadas a los pulmones durante la ventilación mecánica pueden acumularse y conducir a microlesiones y daño estructural, un fenómeno que no puede ser totalmente capturado al medir simplemente presiones estáticas o volúmenes[2].

El concepto fue formalizado en la literatura por primera vez por Gattinoni et al. en 2016. En su fórmula básica incluía parámetros como el volumen corriente (VT), la frecuencia respiratoria (RR), la presión pico (Ppeak) y la *driving pressure*, con un enfoque predominantemente estático. La idea era que la integración de todas estas variables representaba mejor el riesgo total de lesión pulmonar asociada a ventilación mecánica (VALI) que medir cada parámetro de forma aislada (tabla 1). Tanto el trabajo de Gattinoni et al. como el de investigadores posteriores se centraban en cuantificar la energía mecánica aplicada al pulmón desde una perspectiva simplificada, antes denominada volutrauma y barotrauma o tradicionalmente denominada volutrauma y barotrauma, optimizando la ventilación al limitar las presiones inspiratorias máximas y la presión de conducción (ΔP), sin considerar explícitamente la dinámica del tejido pulmonar[3].

Tabla 1 Principales ecuaciones propuestas desde el año 2016 para el cálculo de la potencia mecánica en volumen control y presión control

Autor	Año	Potencia mecánica (J/min)*	
		VC	PC
Gattinoni	2016	$= RR \times \Delta V \times (P_{peak} - ½ \times \Delta P_{aw})$	—
Serpa (PROVE)	2018	$= V_T \times RR \times (P_{peak} - ½ \times \Delta P)$	—
Becher	2019	—	$= RR \times V_T \times (\Delta P_{insp} + PEEP)$
Parthar	2019	$= RR \times DV \times (P_{peak} - 0{,}5 \times DP)$	—
Arnal	2019	$= RR \{V_T^2 [½ E_{rs} + RR ((1 + 1/E)/(60 + 1/E)) R_{insp}] + V_T \times PEEP\}$	—
Chiumello	2020	$= RR \times V_T \times [P_{peak} - ½ (P_{plat}\text{-}PEEP)]$	$= RR \times V_T \times (PEEP + \Delta P_{insp})$
Costa/Amato	2021	$= V_T \times RR \times [PEEP + 0{,}5 \times P + (P_{peak} - P_{plat})]$	—
Becker	2021	$= V_T \times RR \times (P_{peak} - 0{,}5 \times DP)$	—
Yongpeng	2021	$= RR \times V_T \times (P_{peak} - ½ DP)$	—
Zhu	2021	$= V_T \times RR \times (PIP - \Delta P \times 0{,}5)$	—
Santer	2022	$= RR \times V_T \times (PEEP + ½ [P_{plat} - PEEP] + [P_{peak} - P_{plat}])$	—
González-Castro**	2023	= Strain subrogated × PEEP × Strainrate subrogated × RR	= Strain subrogated × V_{Te} × PEEP × Strainrate subrogated × RR

* Aplicar factor de conversión: 0,098.
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