

LETTER TO THE EDITOR

Open Access



# Diaphragmatic facilitation speeds up recovery?

Abhishek Bharadwaj<sup>1\*</sup> and Jitendra Kalbande<sup>2</sup>

**Keywords** Recovery, Muscle relaxant, Diaphragmatic facilitation, Extubation

To the editor,

Often, we encounter a situation where the time since the last dose of muscle relaxant has exceeded its usual duration of action. Still, there is no return of spontaneous ventilation. Here we have a case of a 20-year-old, 60-kg patient posted for excision of the nasal mass. At the end of the surgery, the time since the last dose of vecuronium was 30 min, and the TOF ratio was 0.9. Initially, the patient was put in a pressure support mode of ventilation with a trigger kept at 1.0L/min, but there was no spontaneous effort. To stimulate spontaneous breathing, the following maneuvers were executed: (1) Hands were kept on the upper part of the chest wall, just below the clavicles, with a slight posterior caudal pressure to the chest wall during exhalation. While inhaling, hands exerted a small direct resistance against the expanding upper ribs. (2) Secondly, during exhalation, slight compression of the lower lateral regions of the chest wall was done in the caudal medial direction. During the inhalation phase, a slight direct resistance was applied to the lateral expansion of the lower ribs. (3) Subsequently, hands were placed over the sternum, and slight resistance was applied in the caudal-posterior direction. During inhalation, a slight direct resistance was applied to the expansion of the upper chest wall. (4) Finally, hands were placed just below the costal arches, and slight lengthening of the diaphragm was done in the posterior-superior direction during exhalation. A

slight posterior–superior guiding resistance against the expanding abdominal wall was applied during inhalation facilitating and stimulating the diaphragm to shorten (Zwoliński et al. 2022) (Fig. 1). After two cycles of these maneuvers, the patient started taking spontaneous breaths and responding to a trigger of 1 l/min, following which reversal was given. The patient was extubated after fulfilling the mandatory criteria. The maneuvers we used here generally improve and develop well-coordinated breathing in chronic ICU patients dependent on mechanical ventilation. The pressures applied should just be enough to compress the skin, subcutaneous tissues, underlying muscles, and rib cage and adequate enough to stimulate the diaphragm. Application of this pressure may momentarily increase intragastric pressure however these maneuvers were performed in a mechanically ventilated patient with a cuffed endotracheal tube in situ, further reducing the possibility of aspiration. These diaphragmatic facilitation techniques focus on stimulating the nerves and muscles associated with respiration, promoting optimal diaphragmatic contraction and improving overall respiratory performance and stimulation of spontaneous breathing which differs from a partially closed adjustable pressure-limiting (APL) valve that serves to set pressure limits for manual ventilation and applies controlled pressure to the airways. We believe applying these maneuvers in paralyzed patients under GA can aid in recovery from a long-acting muscle relaxant, especially in patients with decreased pulmonary reserve like the obese. In this particular case, no hemodynamic changes were observed during the maneuvers as is corroborated by a randomized control trial performed by Zwoliński et al. in critically ill patients (Zwoliński et al. 2022). However basic hemodynamic

\*Correspondence:

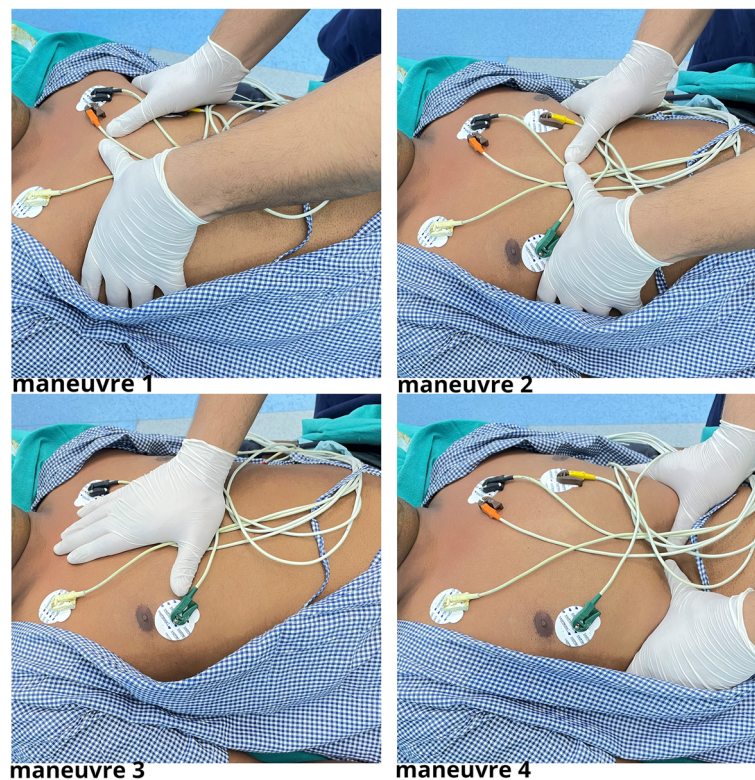
Abhishek Bharadwaj  
bharadwaj.abhishek@gmail.com

<sup>1</sup> Raipur Institute of Medical Sciences, Raipur, Chhattisgarh 492006, India

<sup>2</sup> AIIMS Raipur, Raipur, Chhattisgarh 492099, India



© The Author(s) 2023. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.



**Fig. 1** The pictures labeled as maneuvers 1 to 4 show the different maneuvers performed in the patient to facilitate recovery from muscle relaxants. Maneuver 1—hands placed over the upper part of the rib cage. Maneuver 2—hands placed over the lower part of the rib cage. Maneuver 3—hand placed over the sternum. Maneuver 4—hands placed below the costal margin

monitoring is required and in case of any sudden hemodynamic compromise, maneuvers should be halted immediately. A large-scale study must be done to establish the adequate pressures required, wider applicability, and safety of these maneuvers in the recovery of patients undergoing surgeries of the abdomen and thorax.

#### Abbreviations

TOF	Train of four
ICU	Intensive care unit
GA	General anesthesia
APL valve	Adjustable pressure-limiting valve

#### Acknowledgements

Not applicable.

#### Authors' contributions

Dr. AB discussed the idea and design of the article with Dr. JK. Dr. AB prepared the initial manuscript, edited by Dr. JK. All authors read and approved the final manuscript.

#### Funding

Not applicable.

#### Availability of data and materials

Not applicable.

#### Declarations

##### Ethics approval and consent to participate

Consent to participate is taken from the patient.

##### Consent for publication

We have taken informed consent for the collection of patient information and publication.

##### Competing interests

The authors declare that they have no competing interests.

Received: 26 October 2022 Accepted: 22 July 2023

Published online: 01 August 2023

#### Reference

Zwoliński T, Wujtewicz M, Szamotulska J, Sinoracki T, Wąż P, Hansdorfer-Korzona R, Basiński A, Gosselink R (2022) Feasibility of chest wall and diaphragm Proprioceptive Neuromuscular Facilitation (PNF) techniques in mechanically ventilated patients. *Int J Environ Res Public Health* 19(2):960. <https://doi.org/10.3390/ijerph19020960>

#### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.