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EDITORIAL

New weaning indices in chronic obstructive pulmonary disease population

Mechanical ventilation (MV) is one of the most common therapeutic modalities provided in the intensive care unit (ICU) [1–3]. Among mechanically ventilated patients, those with chronic obstructive pulmonary disease (COPD) are certainly the most difficult to wean and to extubate [4] owing to more than 50% of the time the patient is receiving MV is spent in the process of weaning [5].

COPD is a progressive degenerative lung disease [6], a major public health burden [7], highly prevalent worldwide [8] causing major morbidity. COPD was identified as the fourth leading cause of death in the United States and the sixth leading cause of years lived with disability [6].

The prevalence of extubation failure was 24% in COPD patients and they have the highest risk for reintubation. Reintubation is an independent risk factor for nosocomial pneumonia, increased costs, lengths of stay, and mortality in mechanically ventilated patients [9], and those patients with extubation failure are up to 7 times more likely to die in the hospital compared with those who are weaned successfully [4].

Furthermore, accurate weaning time is critically important in the population because of any delay or premature ventilation removal may lead to ventilator acquired pneumonia and other possible side effects [1,2,9–14].

In the past 2 decades, great efforts have been devoted to define the most effective approach to weaning patients from MV in different ICU designs and structures [1]; because weaning critically ill patients from MV is a gradual and challenging process [1,10,11].

In this regard, many different weaning predictors have been proposed [10]. In the McMaster review and guidelines, 66 predictors of weaning were reviewed and analyzed. Only eight, including the rapid shallow breathing index (RSBI) or the f/Vt ratio, presented significant likelihood ratios to predict the weaning outcome [15,16].

Along with the international weaning predictors, some Iranian weaning researchers developed ten weaning predictors (NCT01779297) (Table 1). The weaning predictors were validated in the COPD population as student dissertation and have well to excellent results (Table 2).

However, some internal and external validations are needed for more approving in the mentioned population.

Author contributions

MRHE, KGM and AVA have made substantial contributions to conception and design, have been involved in drafting the manuscript or revising it critically for important intellectual content, have given final approval of the version to be published, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity

Table 1 Weaning predictors.

First:	$[(P_aO_2/P_{ALV}O_2)/(RSBI*FiO2)]$
Second:	$[(P_aO_2/P_{ALV}O_2)/(RSBI*FiO2*P0.1)]$
Third:	$[(P_aO_2/P_{ALV}O_2)*(NIF)/(RSBI*FiO2)]$
Fourth:	$[(P_aO_2/P_{ALV}O_2)*(NIF)/(RSBI*FiO2*P0.1)]$
Fifth:	$[(NIF)/(P0.1)]$
Sixth:	$[(SaO2)/((P_{ALV}O_2–P_aO_2)*RSBI*FiO2)]$
Seventh:	$[(SaO2)/((P_{ALV}O_2–P_aO_2)*RSBI*FiO2*P0.1)]$
Eighth:	$[(SaO2*NIF)/((P_{ALV}O_2–P_aO_2)*RSBI*FiO2)]$
Ninth:	$[(SaO2*NIF)/((P_{ALV}O_2–P_aO_2)*RSBI*FiO2*P0.1)]$
Tenth:	$[(SaO2)/((P_{ALV}O_2–P_aO_2)*P0.1)]$

Table 2 Validation of weaning predictors in COPD population.

Sensitivity (%):	72–98%
Specificity (%):	68–99%
Positive predictive value (PPV):	70–95.5%
Negative predictive value (NPV):	68.6–98.7%
Positive likelihood ratio (LR+):	1.43–14.5
Negative likelihood ratio (LR−):	0.002–3
Diagnostic accuracy (DA%):	65–100%
Probability of the weaning success if test is negative (P (W+/T−)%):	31.4–1.3%
Probability of the weaning success if test is positive (P (W+/T+)%):	70–95.5%
Area under the curve ± standard error (AUC ± SE)%:	0.789 ± 0.02–0.998 ± 0.07

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of any part of the work are appropriately investigated and resolved.

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Conflict of interest

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References

[1] M. Danckers, H. Grosu, R. Jean, R.B. Cruz, A. Fidellaga, Q. Han, et al., Nurse-driven, protocol-directed weaning from mechanical ventilation improves clinical outcomes and is well accepted by intensive care unit physicians, J. Crit. Care 28 (4) (2013) 433–441.

[2] T.N. Chung, I. Yoon, J.S. You, J.Y. Lee, I. Park, S.P. Chung, et al., Mechanical ventilation in the emergency department for 24 hours or longer is associated with delayed weaning, J. Crit. Care 27 (6) (2012) 740, e9-e15.

[3] J.B. Morato, M.T. Sakuma, J.C. Ferreira, P. Caruso, Comparison of 3 modes of automated weaning from mechanical ventilation: a bench study, J. Crit. Care 27 (6) (2012) 741, e1-e8.

[4] F. Vargas, A. Boyer, H.N. Bui, L.R. Salmi, H. Guenard, D. Gruson, et al., Respiratory failure in chronic obstructive pulmonary disease after extubation: value of expiratory flow limitation and airway occlusion pressure after 0.1 second (P0. 1), J. Crit. Care 23 (4) (2008) 577–584.

[5] A.E. Elgazzar, M. Walaa, A. Salah, A.R. Yousif, Evaluation of the minute ventilation recovery time as a predictor of weaning in mechanically ventilated COPD patients in respiratory failure, Egypt. J. Chest Dis. Tuberculosis 62 (2) (2013) 287–292.

[6] B.K. Solomon, K.G. Wilson, P.R. Henderson, P.A. Poulin, J. Kowal, D.A. McKim, A Breathlessness Catastrophizing Scale for chronic obstructive pulmonary disease, J. Psychosom. Res. 79 (1) (2015) 62–68.

[7] L. Ng, L.K. Chiang, R. Tang, C. Siu, L. Fung, A. Lee, et al., Effectiveness of incorporating Tai Chi in a pulmonary rehabilitation program for Chronic Obstructive Pulmonary Disease (COPD) in primary care—a pilot randomized controlled trial, Eur. J. Integr. Med. 6 (3) (2014) 248–258.

[8] V. Weingaertner, C. Scheve, V. Gerdes, M. Schwarz-Eywill, R. Prenzel, C. Bausewein, et al., Breathlessness, functional status, distress, and palliative care needs over time in patients with advanced chronic obstructive pulmonary disease or lung cancer: a cohort study, J. Pain Symptom Manage. 48 (4) (2014) 569–581, e1.

[9] M. Engoren, J.M. Blum, A comparison of the rapid shallow breathing index and complexity measures during spontaneous breathing trials after cardiac surgery, J. Crit. Care 28 (1) (2013) 69–76.

[10] S. Farghaly, M. Galal, A.A. Hasan, A. Nafady, Brain natriuretic peptide as a predictor of weaning from mechanical ventilation in patients with respiratory illness, Aust. Crit. Care (2015), http://dx.doi.org/10.1016/j.aucc.

[11] M. Carron, S. Rossi, C. Carollo, C. Ori, Comparison of invasive and noninvasive positive pressure ventilation delivered by means of a helmet for weaning of patients from mechanical ventilation, J. Crit. Care 29 (4) (2014) 580–585.

[12] Y. Khalil, E. Ibrahim, A. Shabaan, M. Imam, A.E. Behairy, Assessment of risk factors responsible for difficult weaning from mechanical ventilation in adults, Egypt. J. Chest Dis. Tuberculosis 61 (3) (2012) 159–166.

[13] W.S. El-Shimy, M.A. Barima, G.H. Abo El-Magd, S.A. Mansour, Non invasive ventilation versus synchronized intermittent mandatory ventilation with pressure support in weaning of COPD patients: comparative study, Egypt. J. Chest Dis. Tuberculosis 62 (1) (2013) 159–166.

[14] S. Muttini, P.G. Villani, R. Trimarco, G. Bellani, G. Grasselli, N. Patroniti, Relation between peak and integral of the diaphragm electromyographic activity at different levels of support during weaning from mechanical ventilation: a physiologic study, J. Crit. Care 30 (1) (2015) 7–12.

[15] S.N. Nemer, C.S. Barbas, J.B. Caldeira, T.C. Cárias, R.G. Santos, L.C. Almeida, et al., A new integrative weaning index of discontinuation from mechanical ventilation, Crit. Care 13 (5) (2009) R152.

[16] S.N. Nemer, C.S. Barbas, J.B. Caldeira, B. Guimarães, L.M. Azeredo, R. Gago, et al., Evaluation of maximal inspiratory pressure, tracheal airway occlusion pressure, and its ratio in the weaning outcome, J. Crit. Care 24 (3) (2009) 441–446.

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