Hail the HACOR as a Customized Indian Weaning Score!

Manoj K Singh

It is said that the moment the acute respiratory failure process is reversed post-mechanical ventilation, the process of liberation (i.e., weaning) should be thoughtfully planned.[1] In highly frail or terminal cases where weaning is impossible due to disease dynamics, we generally adopt noninvasive ventilation (NIV) as a means of continuing ventilation.[2] The respiratory demand vs capability mismatch decides the need for ventilation and when capability improves against the disease in context, weaning is possible.[3] This is an ongoing conundrum after the patient is put on mechanical ventilation.

Weaning is defined as simple when the patient passes a spontaneous breathing trial (SBT) on the first attempt. Difficult weaning is when the patient is extubated after 1–3 weaning attempts or takes up to 7 days to wean after the first attempt. If a patient exceeds 7 days or fails 3 SBTs, it is coined prolonged weaning.[3]

The traditional saying was "weaning is an art rather than a science".[4] In the modern era, to ensure that each of our patients fits into the simple weaning process, many criteria, indices, and scoring systems have been laid down. Most of these criteria overcome the physician-related subjective behavior which delays weaning.[5] By adopting structured tools, long-term consequences of mechanical ventilation can be prevented.[3] Additionally clinicians can get objective help to shorten the duration of mechanical ventilation and length of stay, thus reducing the cost. Even unsuccessful extubation attempts can be avoided.[6]

The risk factors for unsuccessful extubation are:[7,8]

- Failure of two or more consecutive spontaneous breathing trials.
- Chronic heart failure.
- Partial pressure of arterial carbon dioxide >45 mm Hg after extubation.
- More than one coexisting condition other than heart failure.
- Weak cough.
- Upper airway stridor at extubation.
- Age ≥65 years.
- APACHE II score >12 on the day of extubation.
- Patients in medical, pediatric, or multispecialty ICU.
- Pneumonia as the cause of respiratory failure.

In this issue of IJCCM, Pratibha Todur et al. present a robust trial about weaning using a new tool called heart rate, acidosis, consciousness, oxygenation, and respiratory rate (HACOR).[9] It is a single-center prospective observational study that included 128 intensive care unit patients undergoing spontaneous breathing trial.[9] Heart rate, acidosis, consciousness, oxygenation, and respiratory score was first studied for described by Duan et al. for the prediction of failure of NIV in hypoxemic patients receiving NIV. Noninvasive ventilation failure was significantly higher in patients with a HACOR score of more than 5.[10] Many studies have

Department of Pulmonary and Critical Care Medicine, Zydus Hospitals, Ahmedabad, Gujarat, India

Corresponding Author: Manoj K Singh, Department of Pulmonary and Critical Care Medicine, Zydus Hospitals, Ahmedabad, Gujarat, India, Phone: +91 9925179799, e-mail: drmanojsingh@gmail.com

studied the utility of HACOR score in weaning of different subsets of patients, including patients with COVID-19.[11] The first study done by Indian authors (Chaudhuri et al.) studied its utility in predicting weaning failure in patients on invasive mechanical ventilation.[12] Patients with HACOR score >5 after 30 minutes of SBT had a high risk of weaning failure with a sensitivity of 83.8% and a specificity of 96.4%. Spontaneous breathing trial termination was decided by clinical score (>5) and rapid shallow breathing index (RSBI). This study represents a novel approach by authors using less resource-intensive variables for weaning which can be done even by any team member in intensive care.

The extubation prediction score (ExPreS) developed by Baptistella, decreased the extubation failure rate even in a cohort of more severely ill patients.[13] In the ExPreS score, the authors included eight parameters likely RSBI, dynamic lung compliance, level of consciousness, muscle strength, serum creatinine level, hematocrit, and neurological comorbidities. In this 100-point scoring system, those with a score of >59 showed high chances of successful extubation, and those with a <44 scores had poor chances of success ($n = 83$).

Feng-Chin Lin et al. proposed the WEANSNOW score in 2020 by taking the following variables: Weaning parameters, Endotracheal tube, Arterial blood gas analysis, Nutrition, Secretions, Neuromuscular-affecting agents, Obstructive airway problems, and Wakefulness.[14] Weaning profile was assessed to meet all of the following criteria: Maximum inspiratory pressure $= -30$ cm H_2O or better; Maximum expiratory pressure $= +30$ cm H_2O or better; spontaneous $V_T \geq 5$ mL/IBW/kg; spontaneous $V_E \leq 10$ L/m; Rapid shallow breathing index < 105 breaths/min/L. Apart from being a complex bedside score, the authors concluded it to work well when the score was 0 in the 205 patients study.

The HACOR score is very simple and easily reproducible. The beauty of this score is that it only needs ABG and simple clinical parameters which can be assessed at bedside when the patient is put on a spontaneous breathing trial. For the ExPreS score, other laboratory investigations like hematocrit and creatinine are

essential, whereas for WEANSNOW, serum albumin, and electrolytes are essential.

In the current study, the authors found that the area under the receiver operating characteristics (AUROC) of HACOR to predict weaning failure was 0.830, and the median SOFA score of patients at ICU admission was much higher. Extubation prediction score had a higher cut-off for weaning success in patients with high SOFA scores (17–24).[9]

The strength of this study is that it included organ dysfunction score, days of mechanical ventilation, steroid administration, and ventilator-associated pneumonia, apart from other respiratory and nonrespiratory variables. The authors concluded that a parsimonious HACOR score is comparable to the ExPreS score for independently predicting weaning outcomes in patients who are showing clinical readiness. Ultrasound-guided weaning in intensive care is a complex and highly observer-dependent skill with its pitfalls and errors.[15] Therefore ultrasonography has not been included in this score. Despite being a single-center study, this is a thought-provoking trial telling us "less is more in weaning"! This novel simple score should be a good addendum to the armamentarium of the intensivists.

Orcid

Manoj K Singh ⬤ https://orcid.org/0000-0002-2097-3438

References

1. Boles JM, Bion J, Connors A, Herridge M, Marsh B, Melot C, et al. Weaning from mechanical ventilation. Eur Respir J 2007;29(5): 1033–1056. DOI: 10.1183/09031936.00010206.
2. Wilson ME, Majzoub AM, Dobler CC, Curtis JR, Nayfeh T, Thorsteinsdottir B, et al. Non-invasive ventilation in patients with do-not-intubate and comfort-measures-only orders: A systematic review and meta-analysis. Crit Care Med 2018;46(8):1209–1216. DOI: 10.1097/CCM.0000000000003082.
3. MacIntyre NR. The ventilator discontinuation process: An expanding evidence base. Respir Care 2013;58(6):1074–1086. DOI: 10.4187/respcare.02284.
4. Milic-Emili J. Is weaning an art or a science? Am Rev Respir Dis 1986;134(6):1107–1108. DOI: 10.1164/arrd.1986.134.6.1107.
5. Blackwood B, Burns KEA, Cardwell CR, O'Halloran P. Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients. Cochrane Database Syst Rev 2014;2014(11):CD006904. DOI: 10.1002/14651858. CD006904.pub3.
6. Hess DR, MacIntyre NR. Ventilator discontinuation: Why are we still weaning? Am J Respir Crit Care Med 2011;184(4):392–394. DOI: 10.1164/rccm.201105-0894ED.
7. McConville JF, Kress JP. Weaning patients from the ventilator. N Engl J Med 2012;367(23):2233–2239. DOI: 10.1056/NEJMra1203367.
8. Nemer SN, Barbas CS. Predictive parameters for weaning from mechanical ventilation. J Bras Pneumol 2011;37(5):669–679. DOI: 10.1590/s1806-37132011000500016.
9. Nayak G, Chaudhuri S, Ravindranath S, Todur P. Comparison of the recent ExPreS score, WEANSNOW score, and the parsimonious HACOR score as the best predictor of weaning: An externally validated prospective observational study. Indian J Crit Care Med 2024;28(3):273–279.
10. Duan J, Han X, Bai L, Zhou L, Huang S. Assessment of heart rate, acidosis, consciousness, oxygenation and respiratory rate to predict non-invasive ventilation failure in hypoxemic patients. Intensive Care Med 2017;43(2):192–199. DOI: 10.1007/s00134-016-4601-3.
11. Guia MF, Boleo-Tome JP, Imitazione P, Polistina GE, Alves C, Ishikawa O, et al. Usefulness of HACOR score in prediction success of CPAP in COVID-19 related hypoxemia. Respir Med 2021;187:106550. DOI: 10.1016/j.rmed.2021.106550.
12. Chaudhuri S, Gupta N, Adhikari SD, Todur P, Maddani SS, Rao S. Utility of the one-time HACOR score as a predictor of weaning failure from mechanical ventilation: A prospective observational study. Indian J Crit Care Med 2022;26(8):900–905. DOI: 10.5005/jp-journals-10071-24280.
13. Baptistella AR, Mantelli LM, Matte L, Carvalho MEDRU, Fortunatti JA, Costa IZ, et al. Prediction of extubation outcome in mechanically ventilated patients: Development and validation of the extubation predictive score (ExPreS). PLoS One 2021;16(3):e0248868. DOI: 10.1371/journal.pone.0248868.
14. Lin FC, Kuo YW, Jerng JS, Wu HD. Association of weaning preparedness with extubation outcome of mechanically ventilated patients in medical intensive care units: A retrospective analysis. Peer J 2020;8:e8973. DOI: 10.7717/peerj.8973.
15. Blanco P, Volpicelli G. Common pitfalls in point-of-care ultrasound: A practical guide for emergency and critical care physicians. Crit Ultrasound J 2016;8(1):15. DOI: 10.1186/s13089-016-0052-x.