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Protocol conception for safe selection of mechanical ventilation settings for respiratory failure Patients

[Lee J.W.W.^a](#) [✉](#), [Chiew Y.S.^a](#) [✉](#), [Wang X.^a](#), [Tan C.P.^a](#), [Mat Nor M.B.^b](#), [Cove M.E.^c](#), [Damanhuri N.S.^d](#), [Chase J.G.^e](#)[Save all to author list](#)^a School of Engineering, Monash University Malaysia, Selangor, Malaysia^b Kulliyah of Medicine, International Islamic University Malaysia, Pahang, Malaysia^c Division of Respiratory and Critical Care Medicine, Department of Medicine, National University Health System, Singapore^d Faculty of Electrical Engineering, Universiti Teknologi MARA, Cawangan Pulau Pinang, Pulau Pinang, Malaysia[View additional affiliations](#) v1 93th percentile
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Abstract

Background and Objective: Mechanical ventilation is the primary form of care provided to respiratory failure patients. Limited guidelines and conflicting results from major clinical trials means selection of mechanical ventilation settings relies heavily on clinician experience and intuition. Determining optimal mechanical ventilation settings is therefore difficult, where non-optimal mechanical ventilation can be deleterious. To overcome these difficulties, this research proposes a model-based method to manage the wide range of possible mechanical ventilation settings, while also considering patient-specific conditions and responses. **Methods:** This study shows the design and development of the “VENT” protocol, which integrates the single compartment linear lung model with clinical recommendations from landmark studies, to aid clinical decision-making in selecting mechanical ventilation settings. Using retrospective breath data from a cohort of 24 patients, 3,566 and 2,447 clinically implemented VC and PC settings were extracted respectively. Using this data, a VENT protocol application case study and clinical comparison is performed, and the prediction accuracy of the VENT protocol is validated against actual measured outcomes of pressure and volume. **Results:** The study shows the VENT protocols’ potential use in narrowing an overwhelming number of possible mechanical ventilation setting combinations by up to 99.9%. The comparison with retrospective clinical data showed that only 33% and 45% of clinician settings were approved by the VENT protocol. The unapproved settings were mainly due to exceeding clinical recommended settings. When utilising the single compartment model in the VENT protocol for forecasting peak pressures and tidal volumes, median [IQR] prediction error values of 0.75 [0.31 – 1.83] cmH₂O and 0.55 [0.19 – 1.20] mL/kg were obtained. **Conclusions:** Comparing the proposed protocol with retrospective clinically implemented settings shows the protocol can prevent harmful mechanical ventilation setting combinations for which clinicians would be otherwise unaware. The VENT protocol warrants a more detailed clinical study to validate its potential usefulness in a clinical setting. © 2021 Elsevier B.V.


Author keywords

and decision making; Mechanical ventilation; Respiratory failure; Respiratory mechanics

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👤 Lee, J.W.W.; School of Engineering, Monash University Malaysia, Selangor, Malaysia;
email:jay.lee1@monash.edu

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