A training programme on basic mechanical ventilation for novel trainees during the COVID-19 outbreak

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Editor—The coronavirus disease 2019 (COVID-19) pandemic led to a massive increase in the number of ventilated patients in hospitals worldwide. Management of hospitalised mechanical ventilation requires specific skills, knowledge, and experience that is usually provided by anaesthesia or intensive care teams. In March 2020, Israel experienced an exponential rise in COVID-19 cases.[1] This rise led to an urgent need for augmenting the number of healthcare providers competent in treating more than 1500 predicted hospitalised mechanically ventilated patients.[2]

We present our Basic Ventilation Support COVID-19 (BVS COVID-19) physician training programme to provide guidance to build a similar programme in other centres. Because of the rapid onset of the COVID-19 outbreak and the uncertainty regarding projected numbers of ventilated patients, our training process needed to be efficient, effective, and flexible, and equipped to train a large heterogeneous group of physicians. Within 2 weeks, we established a three-stage training programme to enable management of a varying number of ventilated COVID-19 patients. Ethical approval was not required to publish details of this process. The BVS COVID-19 training programme comprised a basic knowledge and physiology lecture available online, a practical demonstration performed by an anaesthetist using a ventilator, and a 1 h simulation-based training session. The BVS COVID-19 course was designed to teach physicians to monitor and provide basic routine treatment and focused on three objectives (Table 1): (i) understanding the key principles of basic mechanical ventilation for COVID-19 and teaching lung-protective ventilation principles[3]; (ii) acquiring basic ventilator management skills; and (iii) managing ventilator alerts, approach, and primary response.

Physicians were designated to complete training stages based on priority for recruitment to treat ventilated COVID-19 patients. Stage 1 was provision of a filmed online lecture for all active physicians that presented BVS theoretical knowledge and physiology. This lecture was distributed online via a hospital app and resulted in 3800 online views (Supplementary material A). The second stage was a practical demonstration provided for 500 physicians selected based on anticipated need to cover COVID-19 departments in teams of up to 10 doctors (Supplementary material B). Finally, a multidisciplinary 1 h high-fidelity simulation was designed to provide practical tools for handling ventilator alerts in ventilated COVID-19 patients. This stage was developed as a multidisciplinary simulation-based training for physicians together with nurses (who had completed their separate training), immediately before entering the COVID-19 departments. Each simulation session consisted of two basic scenarios: a high-pressure alert as a result of a mucus plug blocking the tracheal tube (Supplementary material C) and a low-pressure alert as a result of unexpected patient self-extubation (Supplementary material D). Scenarios focused on basic skills: identifying the alert, activating rapid response team, initial troubleshooting, and initiating COVID-19-oriented life-saving interventions.

A cognitive aid for basic ventilator support and alert management was created by an interdisciplinary team of anaesthetic, critical care, and simulation experts. The cognitive aid was used during the simulations and sent to participants, and a laminated version was attached to all COVID-19 department ventilators (Supplementary material E). The total number of mechanically ventilated patients did not reach 100 patients in our centre, and as such, only 27 physicians participated in all three training stages. This three-stage training model enabled our medical centre to provide rapid education of a heterogeneous large cohort of physicians, with rolling admission as needed. Furthermore, given the uncertainty of the numbers, our programme facilitated flexibility for activation as needed.

Internet-based curricula have been widely used for medical education,[45] as we used in our first stage of the training programme with an online recorded lecture. The third step of our training programme included high-fidelity simulation-based training, which has been found to be a significant education method to improve mechanical ventilation.[67] Cognitive aids, such as posters and algorithms, can be used to guide caregivers during tasks or emergency situations to standardise clinical care and reduce errors. More studies are needed to assess the long-term retention of knowledge.

Table 1 COVID-19-oriented basic mechanical ventilation skills training programme objectives and modality. COVID-19, coronavirus disease 2019.

Objective	Teaching/training method	Practical features
Understanding the key principles of COVID-19 basic mechanical ventilation	(i) A 40 min video-based lecture available online	Mechanical ventilation basic concepts and physiology, ventilation parameters review, COVID-19 clinical features, and target ventilation values
Acquiring ventilator management basic skills	(i) Small-group (up to eight participants) classes: demonstration and practice	COVID-19 clinical features and target ventilation values review, ventilator operating and parameter settings, disconnecting procedure, and short introduction to ventilator alerts management
	(ii) Lung-protective ventilation and disconnecting procedure: cognitive aid	Chart with lung-protective ventilation target values and a ventilator tube disconnecting and reattachment procedure checklist
Ventilator alerts management: approach and primary response	(i) Simulation-based training: ventilator alerts management	Simulation based on ventilator alerts in ventilated COVID-19 patients; two nurses and two physicians per scenario; two scenarios: a high-pressure alert (mucus plug) and a low-pressure alert (self-extubation)
	(ii) Alerts management: cognitive aid	A one-page cognitive aid included an algorithm that was adjusted to COVID-19 features and principles. The cognitive aid was used during the simulations and was hung on all COVID-19 department ventilators

At the initiation of our course, 1000 mechanically ventilated cases were expected across Israel during the week of April 6, 2020. Strict social isolation guidelines resulted in a rapid decrease in the rate of rise of mechanically ventilated patients. Thus, the number of ventilated COVID-19 patients in Israel did not reach these adverse forecasts.[1] Our surge strategy was planned for three levels of emergency readiness, up to 100 mechanically ventilated patients, up to 200 mechanically ventilated patients, and 300+ mechanically ventilated patients. Support for complex decision-making would be provided by experienced ICU teams. However, a second wave of severe acute respiratory syndrome coronavirus 2 transmission is currently underway, as we have seen the gradual resumption of economic activities and social interactions enabling viral transmission that might increase the ventilated patient numbers.[8] Hence, we are now prepared to apply our training programme as necessary.

The essential basic ventilation skills COVID-19 training programme we describe is simple, easily replicable, and may enable widespread teaching of basic ventilation skills. Although we were restricted in learner group sizes because of the pandemic, this did not hinder the teaching programme.

Declarations of interest

The authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bja.2020.07.016.

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