

EDITORIAL

Weaning from mechanical ventilation

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Mechanical ventilation is an important part of the healthcare provided in intensive care units and is changing continuously. More and more evidence is becoming available that mechanical ventilation is harmful for patients. Weaning from mechanical ventilation is important since it is an integral part of mechanical ventilation. Mechanical ventilation and weaning are continuously changing. In this issue, the paper written by Verbrugge et al [1], describes the current state of affairs in a broad context with respect to weaning, as well as the direction it will take in the future. We are at an important point in time where questions about the workload of healthcare personnel, compliance with protocols, and automation can possibly be solved with respect to mechanical ventilation and weaning. This editorial will focus on this future direction which is touched on throughout the paper of Verbrugge et al [1]. This is an attempt to give more insight into the important subject of the future direction of mechanical ventilation and weaning.

Why does technology such as mechanical ventilation and weaning change? Changes in healthcare are driven by manufacturers and innovative physicians/nurses [2]. The results of innovations are sometimes just a small software update for a ventilator but may also be entirely new mechanical ventilators with new automated ventilation and/or weaning modalities. In a response to the criticism that the purchase of new equipment is often poorly supported there is increasing emphasis on the importance of safety, benefits, costs and broader implications of new technologies on which purchase decisions can be based [3]. When it comes to approving new medical devices in patient care, clinicians will in general access peer-reviewed evidence for the usefulness of new technology. Information provided by manufacturers is usually not enough. The scientific literature on new medical technology has a role in the evaluation and finally the use of a new medical technology. Clinicians who see a new device as providing research opportunities, and institutions that see it as offering market opportunities, are rapidly motivated to acquire and study the new device, thus becoming 'early adopters'. Their publications help

shape professional consensus regarding the appropriate use of new technology [4]. The power and intelligence with which marketing techniques are used should, however, not be underestimated [5]. It is not uncommon that "innovations" in medicine are generally used in practice even though evidence is lacking. Unfortunately, we must also realize that for many older technologies, i.e. ventilation and weaning modes, adequate evidence is also often lacking.

An important question is whether there is need for changes such as automation of weaning. There are several reasons to believe that the answer to that question should be affirmative. First, there is strong evidence that the outcome of patients admitted to an ICU is related to the workload of healthcare personnel such as nurses and intensivists [6]. The number of actions per patient per day on an IC is approximately 178. Twenty-six percent of these activities are related to breathing or ventilation, in the broadest sense. This means that automation can help to reduce the workload and thus improve outcome. Second, it is expected that the number of ventilated patients will increase. The aging of the "baby boomers" will result in more intensive care patients. In addition, the number of patients who are going to receive prolonged mechanical ventilation will increase, while the number of nurses and intensivists to care for them will decline.

A third reason to automate mechanical ventilation and weaning is the ability to be able to quickly implement changes in daily practice [7]. Automating knowledge transfer saves time. The workload of implementing new protocols is often underestimated. Last but not least, there is the matter of compliance. Examples from other industries show that without any restraints, 1 in every 10 tasks is not completed correctly [8]. Automation of processes can help to boost reliability and this, in turn, will thus lead to better compliance. The example of the application of our knowledge of lung protective ventilation in patients with ALI/ARDS is a typical one. Research shows that lung protective ventilation in patients with ALI/ARDS is often not used [9]. These results show that compliance is a huge challenge in clinical practice. Automation (and decision-support) can solve this problem; weaning protocols in patients with changing respiratory system compliance are able to lower pressure support and notifying users of changes in the patient's condition.

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Automation of mechanical ventilation and weaning will lead to a different approach to the interpretation of the clinical condition of patients. Clinicians will have to look at ventilator behaviour and the messages they give. In a not-so-extreme case, the ventilator will give a signal to the clinician that the patient is ready for extubation. One could argue that the challenge of ventilation and weaning patients will become less. This might be partially true, however, there will always be patients who are difficult to ventilate or to liberate from mechanical ventilation and they will need all our attention. Perhaps more importantly, automation itself is not automated. We will have to give input as to how we want our patients to be ventilated and weaned to be able to take the next step into the future of innovation of mechanical ventilation and weaning.

The complete automation of ventilation and weaning seems close. Technically, at least, it should be possible to build ventilators which use and integrate information on blood gases and preferably also haemodynamics of the patient, so that the protocols we devise with respect to lung protective ventilation, weaning, setting of optimal positive end expiratory pressure, automatic open up procedures etc. can be performed by the mechanical ventilator alone.

In conclusion, improving compliance while lowering workload in healthcare by means of automation will help us deliver better patient care in the near future. New modes of mechanical ventilation and weaning should be implemented only when sound evidence is provided for non-inferiority or superiority of these new technologies.

Conflict of interest: none

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