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Letter to the editor

Response to Letter to Editor: Electrical impedance tomography and inspiratory muscle training in ICU patients

Dear Editor

Thank you for the opportunity to respond to the interesting letter from Zhao et al. about the potential role of electrical impedance tomography (EIT) in inspiratory muscle training (IMT) in intensive care unit (ICU) patients.[1] We agree that EIT may prove a vital adjunct to the toolbox for ICU clinicians. For example, EIT has already been used to identify changes in distribution of ventilation during airway suction.[2] However most ICUs do not yet have access to this technology, and our guideline was written for simplicity and generalisability. There may well be a role for EIT in research into the mechanisms of weaning failure and the efficacy of IMT in ICU patients, although we suspect that identification of muscle fatigue will not necessarily predict successful IMT.

While Zhao et al.[1] state that training intensity requires invasive measurement of maximum inspiratory pressure (MIP), we reiterate that (as outlined in our guideline) suitable candidates for IMT can be identified without the need for invasive measurement techniques. Rather, MIP can be measured simply either through the ventilator itself (e.g., 'negative inspiratory force' function) or using a handheld respiratory meter briefly attached to the endotracheal tube during tracheostomy. Similarly, recently extubated patients can have their MIP assessed using a handheld device. It is worth noting that although we did not cover this application in our guideline, the newest model electronic IMT devices described in recent studies[3,4] also provide a noninvasive MIP measurement function. This is likely to make MIP measurement even more accessible for bedside clinicians. However, we would like to stress that even in the absence of readily available MIP measurement, clinicians can still titrate an appropriate IMT resistance by ensuring that the patient can only just complete the 6th breath in each set using a simple spring-loaded device. While this titration may take longer to achieve (i.e., completion of a few sets to ensure appropriate resistance), it means that many ICUs may be able to offer IMT without the need for specific diagnostic equipment.

We would also like to point out that the EIT images provided in the letter by Zhao et al. are those depicting measurements during various levels of ventilator support (assist-control ventilation vs assisted ventilation with high and low support). We strongly suggest that manipulation of ventilator support (or resistance) is not equivalent to the IMT approach we have outlined in our guideline. Rather, we suspect that the physical separation of the patient from the ventilator and the opportunity to independently and actively perform a small number of highly-resisted breaths are important elements of the success of the technique. Whether EIT can value-add during this high-intensity training would be interesting to explore, and we would welcome future research in this space.

Finally, we respectfully disagree with the statement that IMT does not improve clinical outcomes in ICU patients. A recent meta-analysis showed that IMT improves inspiratory muscle strength, and when studies at high risk of bias are excluded, IMT also reduces the duration of weaning from mechanical ventilation.[5] Furthermore, in a randomised trial of IMT in a cohort of recently extubated patients, significant improvements were found in the quality of life in the IMT group compared with a control group receiving usual care.[6] Although more research is needed to confirm the impact of IMT on clinical outcomes, we believe that current evidence supports making this simple and low-cost intervention available to as many ICU patients as possible. This was our motivation in writing the guideline, and we look forward to future iterations informed by an even stronger evidence base. We would be delighted if research into EIT application further enhanced our understanding of the value of IMT for ICU patients.

Supplementary information

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aucc.2018.10.005.

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