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Letter to the editor

Inspiratory muscle training can be monitored by electrical impedance tomography

To the Editor

We read with interest the article by Bissett et al. using the high-intensity approach for inspiratory muscle training (IMT) in patients with prolonged mechanical ventilation.[1] Because IMT does not necessarily improve clinical outcomes,[2] Bissett et al. proposed a list of indications when to apply IMT including patients awareness, fraction of inspired oxygen, and respiratory rate, which are not direct measures of muscle activities. The training intensity can be monitored with maximum inspiratory pressure, which needs to be measured invasively through the tracheostomy or using an endotracheal tube and not suitable for patients who are recently weaned. Therefore, a continuous bedside tool is warranted to assess the inspiratory muscle status and the efficacy of IMT. We recently monitored the weaning process in patients with prolonged mechanical ventilation using electrical impedance tomography

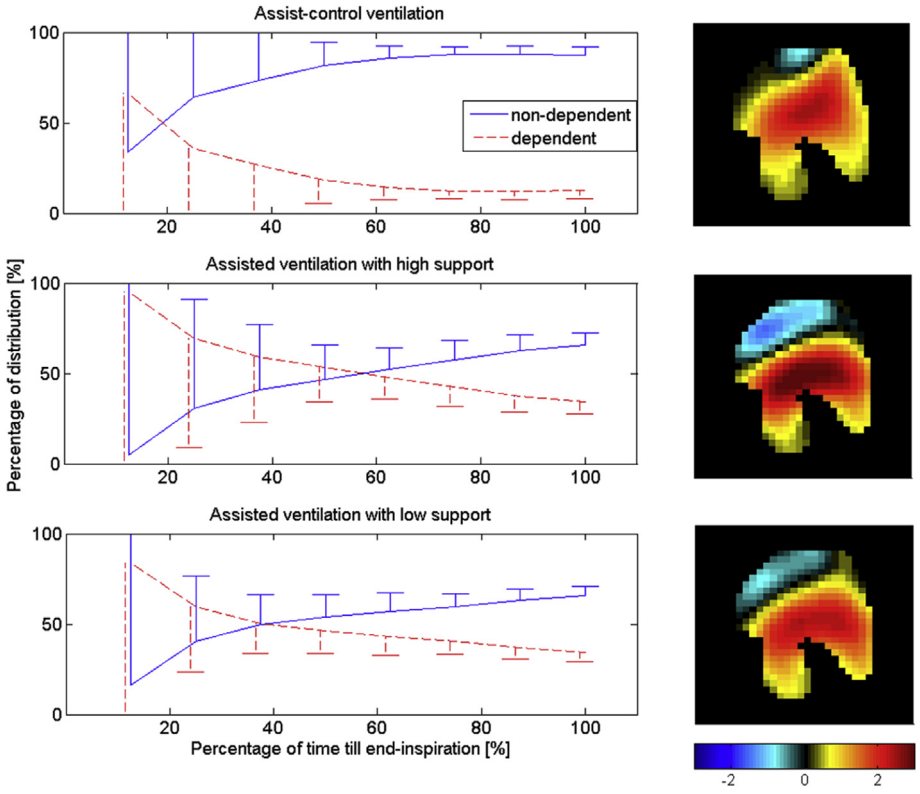

Fig. 1. Intratidal gas distribution during assist-control ventilation (top) and assisted ventilation with a high (middle) and low level of support (bottom). Percentages of ventilation distributed into ventral (blue solid lines) and dorsal (red dashed lines) regions were calculated at eight time points during inspiration. Each support level lasted an hour. Medians and interquartile ranges during the last 5 min of each phase are plotted. Ventilation distributions at 25% of inspiration are shown in the functional EIT images on the right. The stronger posterior diaphragm excursion 'sucked' air from the anterior regions, which deflated at the beginning of inspiration, leading to a pendelluft phenomenon.[4] Red and blue regions in the EIT images highlight the increase and decrease in regional impedance, respectively, when compared with the start of inspiration. EIT, electrical impedance tomography.

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(EIT).[3] The results of our study imply that EIT may monitor muscle activities during IMT process and identify the patients at risk of weaning failure. To be specific, we found that intratidal ventilation redistribution detected improvement or muscle fatigue during IMT (Fig. 1). Typically, the lower the support level is, the higher the percentage of ventilation became in dorsal regions in patients who were successfully weaned. On the contrary, a decrease in ventilation (instead of increase) in dorsal regions with lower support level indicated early respiratory distress (see last row in Fig. 1). We believe that by monitoring the intratidal ventilation redistribution in real time at the bedside, patients who require IMT can be identified. Besides, Bissett et al. mentioned that there are different IMT approaches available, in which the effects and tolerances vary in different patient populations.[1] With our proposed EIT method, patients' immediate responses to IMT can be measured, so that individual-tailored IMT strategies can be applied.

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