

Excitability of motor cortical output to human scalenes muscles is altered by lung volume

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Purpose: Pulmonary afferents are known to inhibit inspiratory output from the medulla with increasing lung volume. The aim of this study was to assess the effect of pulmonary afferent feedback on the excitability of motor cortical output to the respiratory muscles.

Methods: In 8 subjects lying supine, motor evoked potentials (MEPs) were recorded from the right scalenes muscles in the neck (obligatory inspiratory muscle) and from biceps (non-respiratory muscle). Pulmonary afferent feedback was altered by changing lung volume. Subjects performed two manoeuvres (10 trials each): (1) incremental inspiration from functional residual capacity (FRC) to total lung capacity (TLC) and (2) incremental exhalation from TLC to FRC. High-intensity transcranial magnetic stimulation (75-95% stimulator output) was delivered over the motor cortex during relaxation at three lung volumes; FRC, FRC + 40% inspiratory capacity, and FRC + 90% inspiratory capacity. Prior to stimulation, the breathing apparatus was closed so that subjects could relax at each volume.

Results: The amplitude and area of the MEPs recorded from the scalenes muscles were ~50% greater at a high lung volume compared to lower lung volumes ($p < 0.001$). However, there was no difference in MEP size for the same lung volume in inspiratory and expiratory manoeuvres. In the control muscle biceps, the size of MEPs was similar at all lung volumes and in the two manoeuvres ($p \geq 0.2$).

Conclusion: The results suggest that unlike their effect at the medulla, pulmonary afferents activated at high lung volume increase the excitability of the motor cortical output to inspiratory muscles.