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Ex-vivo effects of intrapulmonary percussive ventilation on sputum rheological properties

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Abstract

Intrapulmonary percussive ventilation (IPV) has been postulated to enhance mucociliary clearance by improving tracheobronchial sputum rheological properties. The IPV effects on linear (viscoelasticity) and non-linear (flowing) rheological properties of 40 sputum samples collected from 19 patients with muco-obstructive lung diseases were investigated ex-vivo. Each sputum sample was split into 4 aliquots. These aliquots were independently placed in a circuit connected on one side to an IPV device and on the other side to a lung model that simulated spontaneous adult breaths. IPV was superimposed on simulated breathing. Three aliquots were exposed to a different IPV setting, modifying either percussion frequency or amplitude (4 Hz-200 L/min, 10 Hz-200 L/min, 10 Hz-140 L/min). One aliquot was only exposed to breathing (IPV was switched off, control condition). Each aliquot underwent 5 min of the pre-fixed mechanical stimulation before being recollected to proceed to rheological analysis. Neither percussion frequencies nor amplitudes had a significant impact on any sputum rheological properties studied. These results need to be confirmed in vivo. © 2023 Elsevier B.V.

Author Keywords

Airway clearance techniques; Intrapulmonary percussive ventilation; Rheology; Sputum; Viscoelasticity

Index Keywords

adult, Article, breathing, ex vivo study, flow kinetics, human, in vivo study, intrapulmonary percussive ventilation, lung model, mechanical stimulation, mechanical stress, obstructive lung disease, percussion, shear rate, sputum, viscoelasticity, lung, percussion; Adult, Humans, Lung, Percussion, Respiration, Sputum

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